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See Page 69

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WHAT features do you want in a tool? What will help you do a better job, in less time, at less cost? That's what counts! Not what we, as manufacturers, think you should have.

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MONTHLY Founded 1872

381 Fourth Avenue
New York, N. Y.

Table of Contents for January, 1931

LEADING ARTICLES

SPECIAL FEATURES

ASTRONOMY

AUTOMOBILES

AVIATION

ENGINEERING

January, 1931, Vol. 118, No. 1. **Popular Science Monthly** is published monthly at 381 Fourth Avenue, New York, N. Y., by the Popular Science Publishing Co., Inc. Entered as second-class matter Dec. 29, 1916, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Dayton, Ohio. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A. Single copy, 25 cents. Nine months' subscription, $2. Yearly subscriptions to United States, its possessions, and Canada, $2.50; foreign countries, $3. The contents of this magazine must not be reprinted without permission. The editors are not responsible for unsolicited contributions, and cannot guarantee the return of such material or insure against its loss. In presenting numerous stories of the new products of applied science, **Popular Science Monthly** does not underwrite the business methods of the individuals or concerns producing them. The use of **Popular Science Monthly** articles for stock-selling schemes is never authorized. A. L. Cole, President and Treasurer; R. C. Wilson, Vice-President; John Nichols, Vice-President; F. W. Briggs, Secretary.

Popular Science Monthly for January, 1931

Investment Trusts —and Investment Busts

By LEON MEADOW, *Financial Editor*

LARRY MICHAELS had an appointment for lunch with his friend, Al Langley, an investment broker. As they walked into their favorite restaurant, there seemed to be an extraordinary amount of conversation, loud and otherwise, floating around the room. At least it sounded so to Larry, and after they had given their orders, he said to Langley, "Say, Al, what do you suppose is causing all this 'hub-bub'—another market crash? You know, I don't follow those things very closely, although I have made a few investments—small, but sound—from time to time."

Michaels laughed. "Don't you read the papers? A stock exchange firm of long standing was suspended yesterday. That's probably what all the excitement is about."

"Oh, I saw that. Weren't they involved in some underwriting commissions of their own that panned out badly and finally caused this failure? And didn't that firm own an Investment Trust, too?"

"It certainly did," Langley replied. "By the way, if you're interested in investment trusts—this brokerage suspension brings up an important point about that form of investment."

"Let's hear it, Al. I'd like to know more about it."

"Well forget about this particular Trust for a minute. I'd like to give you a clear picture of the history behind Investment Trusts. In England and Scotland they have been in existence since 1856 and, backed by almost 75 years of experience, these British Trusts have come to be what you might call the finished product—with all impurities drawn off in their development. The English people have rewarded their fine record by looking upon and buying Investment Trust Debentures and Preferred Stocks with almost as much approval and safety as they do their own government bonds. And in the twenty years dating from 1909 to 1929 the ten leading British and Scottish Trusts advanced in average dividend rate from 5.8% to 14.3%—sliding back only a trifle during the war years of 1916 and 1917. That represents actual cash dividends paid, not merely earnings. I think that's sufficient proof of the desirability and integrity of the English Investment Trust as developed today."

"What kind of a trust is it?" interrupted Michaels.

"Almost without exception," Langley replied, "the General Management Type—in which emphasis is placed upon a broadly diversified group of securities under flexible management. Often, their portfolios—or securities held—include majority stock of other large companies interested in general and special fields of finance. The scope of the Trust's portfolio takes in a wide range of the leaders in all fields—industry, rail, utility, insurance, investment, etc. The cream of foreign market offerings is also included. And only long established securities with proven records of earnings are bought by these Trusts."

"That seems logical enough, Al. Now tell me—or suppose that I'm a prospective investment trust shares buyer—and having learned all of what you've just outlined—I would like to know how trust shares like those offered by the brokerage house that failed differ from those sponsored by English Trusts. What's your answer?"

"Plenty! I'd say there's no sense comparing them. First place, you have no right considering the purchase of any investment trust whose management does not keep its subscribers periodically informed of the changes, if any, in its portfolio and in its management. For another thing, you should never risk purchasing trust shares, whose portfolio includes recently established companies or newly underwritten securities. Because the trust's main reason for existence is its ability to pool all the individual's small amounts—and so place each one in a position to share in the purchase of stocks and bonds of the *world's greatest* leaders in *every field*. Do you know what happened in the case of the Trust organized by this brokerage house? Common and preferred stocks were issued—and the corporation was under way. But instead of these funds being used for the purchase of *only* the highest grade securities as they are in the English type of Trust—a large portion went to buying stocks of companies whose issues had been floated by the same brokerage house—and in which they were naturally interested and involved. Of course, when the stock market continued to slide downward and business conditions continued to affect even our largest industrial leaders—these new and untried companies whose stocks they had underwritten were hit badly and the value of the portfolio, with a large portion of its funds in those new issues—slumped fearfully. Now you can buy the common stock for next to nothing—and that's about what it's worth. Furthermore, no portfolio of securities was published. There was no telling what changes, if any, were being made from time to time. Legally, they can't be forced to publish such a statement—but their failure to do so is enough to condemn their principles or at least caution greatly the advisability of purchasing their trust shares or those of any other investment trust following similar tactics."

"That certainly is interesting. As a prospective buyer I certainly would want to know facts like that. If all our investment trusts are organized like that . . ."

"Hold on, Larry," Langley interrupted, "I didn't say anything like that and I didn't want you to draw such a conclusion. The American Investment Trust is still in its infancy. *(Continued on page 5)*

INVESTMENT TRUSTS. . . AND INVESTMENT BUSTS

(Continued from page 4)

But one of the oldest and largest in this country—organized about ten years ago—is patterned after the English type. Briefly, it is somewhat like a trust within a trust. That is to say, the main structure is composed of five separate holding companies, all investment trusts within themselves and each independent of the other, but all under the direction of a sixth or parent corporation. At its head, as you would expect of such a company, is the directing board, composed of some of the finest banking minds in the United States. The flexibility of this trust allows the directors ample liberty. It makes use of their experience and knowledge by leaving in their hands the selection of the portfolio and the changes to be made from time to time, as conditions demand or make desirable. It also charges them to publish every six months a complete report of all the securities currently held, the amount of shares of each security, the cash reserve and all other information of vital importance to the shareholders. In others words, Larry, your money is being invested for you by men with proven records of success in their own financial fields, and their selection is submitted to you regularly."

"That's as it should be," was Larry's comment. "Now tell me, Al—when you say it's one of the largest investment trusts in the country, what do you mean by large?"

"Their last statement was issued in September, and that report showed that the total value of the securities in the portfolio was in the neighborhood of $300,000,000, figuring their holdings at cost to them. Their cash resources, including bank deposits and money loaned out at call, was over $13,000,000. When you consider the strength of a firmly established, well organized trust like that and add to it the strength of a few other, not quite so large but equally dependable, it isn't hard to see that even now the *right* kind of investment trust is a tremendous influence in the financial activities of this country."

"Say," interrupted Larry, "that is big! I certainly had no idea they reached that size. But now that you've brought out all these points about management, resources and operating principles, it's simple enough to see the essential differences between the two types you have contrasted—and how relatively easy it should be for a person to select the better one."

"Of course, there is a vast difference," Langley continued. "And you'd never think people would have any trouble picking the right one. But the trouble is most people don't want to stop and consider even so much as the obvious differences, no less the finer ones. Well, one thing is certain. If they would only go into these things with their eyes open, they'd soon steer clear of investment busts such as that brokerage house organized. And, if they'd only take the time to learn and understand those essential, obvious differences instead of just

(Continued on page 6)

INVESTMENT TRUSTS, . . . AND INVESTMENT BUSTS

(Continued from page 5)

blindly following a mass rush toward investment trusts—simply because they happen to be riding on a boom market—and if they'd learn to separate the chaff from the wheat instead of picking everything and anything regardless of value—then our Investment Trusts would be headed for a far sounder basis, and might gradually attain the high and justified position this type of financing now enjoys in England and Scotland."

Not long after, the two men left the restaurant. All the talk and excitement that Larry had noticed upon entering was still buzzing around the room. Evidently the brokerage failure was the main financial topic of the day. Michaels parted with his friend and went his way, feeling that he had really learned something of importance. He had in mind no plans for immediate investing, but he intended to remember Langley's advice. Should he ever consider buying investment trust shares at some future date, he would do so *only* after a thorough investigation and understanding of their holdings, organization and management.

Sound Investment Trust Shares are ideal securities for the average investor who wishes to own the highest quality stocks and bonds, but has not enough money to do so through direct purchase. Over a period of years this type of stock will prove itself one of most desirable investments in American finance. The fundamentally sound trusts will grow and are certain to reward their share holders handsomely.

It is of first importance when selecting investment trust stocks to investigate thoroughly the management connected with it and to judge correctly not only the trust's resources, but also the management's ability to use these resources in ways that will bring utmost benefit to the stock holders whose confidence they have gained.

For the past three years POPULAR SCIENCE MONTHLY has carried this Getting Ahead Department as a regular monthly feature. It has been the aim of the editor to discuss financial subjects of interest and application to the average man or woman. We have written at various times about life insurance, building and loan associations, mortgage bonds, investment trusts, public utilities and other classes of securities of mutual interest, about budget plans for accumulating a somewhat modest fortune quickly and safely and about various phases pertaining to personal and family finance.

The financial editor would welcome letters from readers indicating subjects in which they have particular interest. Letters relating personal experiences in getting ahead, or giving the details of plans or methods which have succeeded, or failed, are also welcome. We extend this invitation to write us as a means of making this department of greatest usefulness to our readers. *(Continued on page 7)*

INVESTMENT TRUSTS. . .
AND INVESTMENT BUSTS

(Continued from page 6)

To Help You Get Ahead

THE Booklets listed below will help every family in laying out a financial plan. They will be sent on request.

Your Income and Your Life Insurance is the name of a brief booklet scientifically answering the question "How much life insurance does a man really need?" Provident Mutual Life Insurance Company of Philadelphia, Pennsylvania, will mail a complimentary copy upon request.

The House Behind the Bonds reminds the investor of the importance, not only of studying the investment, but of checking up the banker who offers it. Address: Fidelity Bond & Mortgage Co., 1188 New York Life Building, Chicago, Ill.

How to Get the Things You Want tells how you can use insurance as an active part of your program for getting ahead financially. Phoenix Mutual Life Insurance Company, 328 Elm Street, Hartford, Conn., will send you this booklet on request.

Enjoy Money shows how the regular investment of comparatively small sums under the Investors Syndicate plan, with annual compounding of 5½% interest, builds a permanent income producing estate, a financial reserve for a business, or a fund for university education or foreign travel. Write for this booklet to Investors Syndicate, Investors Syndicate Building, Minneapolis, Minnesota.

How to Retire in Fifteen Years is the story of a safe, sure and definite method of establishing an estate and building an independent income which will support you the rest of your life on the basis of your present living budget. Write for the booklet to Cochran & McCluer Company, 46 North Dearborn St., Chicago, Ill.

See How Easy It Is tells how it is possible to start off with a definite plan for creating an immediate estate leading to future financial security. Get your copy of this booklet by writing to Postal Life Insurance Company, 511 Fifth Avenue, New York City.

A Service for Readers

THIS Financial Department is to help readers in the establishment of proper financial programs at the beginning of their business careers; it assists those who have accumulated money in the proper investment of it.

The Editor of this Department is ready to aid in personal investment problems. Advice will be gladly given regarding the proper investment of funds and proper plans of saving.

Address your inquiries to Leon Meadow, Financial Editor, POPULAR SCIENCE MONTHLY, 381 Fourth Avenue, New York. While investments obviously cannot be guaranteed by the Publisher, every effort will be made to assure that only advertisements of absolutely reliable companies are accepted.

INDEX
Guaranteed Advertisements

Popular Science GUARANTEE

POPULAR SCIENCE MONTHLY guarantees every article of merchandise advertised in its columns. Readers who buy products advertised in POPULAR SCIENCE MONTHLY may expect them to give absolute satisfaction under normal and proper use.

Tools, Radio Apparatus, Oil Burners and Refrigerators advertised in POPULAR SCIENCE MONTHLY have been tested or investigated by the Popular Science Institute of Standards and each advertisement carries the insignia indicating approval.

However, other products advertised in the magazine not subject to test carry the same guarantee to readers as products tested.

THE PUBLISHERS

INTO THIS one brilliant book of 280 pages have been condensed the outstanding facts that scientists have discovered since Aristotle, the father of science, dissected a frog to see what made its heart beat.

How often have you wanted to know about the wonderful discoveries in science that have so changed the world we live in . . . the secret of radium . . . the romance of the atom . . . the origin of the earth!

Or you may have wanted to know why glass is transparent . . . how fireflies produce light . . . why the grass is green . . . if radio waves move in a straight line?

All of these questions, and hundreds of others, have now been answered, for the first time, in one book—THE POCKET GUIDE TO SCIENCE.

All that you probably will ever want to know about science is told in this one book that will fit in your pocket or grace a library table. The curiosity-satisfying facts about the world we live in are made instantly available to you in simple question-and-answer form in THE POCKET GUIDE TO SCIENCE.

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YOU are assured of the accuracy of the answers in The Pocket Guide to Science because it has been edited by Dr. J. H. Ivee, the distinguished author of "The Story of Man and His Work." Dr. Ivee has a remarkable genius for condensing the known facts about scientific questions into vivid, easily remembered paragraphs.

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THE POCKET GUIDE TO SCIENCE is not for sale. It is offered to you *without one penny extra cost*, with a 14 months' subscription to POPULAR SCIENCE MONTHLY.

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In every issue of POPULAR SCIENCE MONTHLY are a dozen or more important articles that explain and picture the most fascinating and significant new developments, discoveries, and undertakings in exploration, in engineering, in health, in electricity, in medicine, and in every branch of science.

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But all this is only part of the contents of one issue of the amazing POPULAR SCIENCE MONTHLY. It takes over 300 articles and pictures every month to tell the readers of POPULAR SCIENCE MONTHLY all that has happened in the scientific, radio, mechanical, and automotive fields.

A Few of the Hundreds of Questions Answered in the POCKET GUIDE TO SCIENCE

Why does static interfere with radio messages?
What signal makes penguins go to sea or keeps them there?
Why do we grow old?
What is the safest stimulant?
What is the function of the liver?
Why are leaves red?
Can energy be destroyed?
Why can't you skate on glass if it is smoother than ice?
How does a self-winding clock work?
Why does an earthquake occur?
Can we see atoms with a microscope?
What are electrons?
Is electricity a form of matter?
What is a vacuum?
How large is the universe?
Why do the stars twinkle?
How do we know what the stars are made of?
Is the inside of the earth molten?
What is an electric spark?
What makes the noise of thunder?

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We will stamp your name in 22-carat gold on the cover of THE POCKET GUIDE TO SCIENCE *at no extra cost to you* if you use the coupon below immediately.

You are offered a 14 months' subscription to POPULAR SCIENCE MONTHLY (regular price if bought by the month would be $3.50) with THE POCKET GUIDE TO SCIENCE—all for $2.95, plus the few cents' postage. If you are already a subscriber to POPULAR SCIENCE MONTHLY we will be glad to extend your subscription 14 months if you accept this offer.

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I accept your offer of THE POCKET GUIDE TO SCIENCE and a 14 months' subscription to POPULAR SCIENCE MONTHLY. I will pay the postman $2.95 plus the few cents postage when he delivers the POCKET GUIDE and the first issue of POPULAR SCIENCE MONTHLY. If the book and magazine are not fully satisfactory to me I will return them within 10 days and you are to promptly refund my full payment. Please stamp my name on gold.

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1-31

Radio Tubes Today and to Come

An Army of Research Workers and Millions of Dollars Are Back of the Modern Tubes

By

F. G. PRYOR

Secretary, Popular Science Institute

A VAST amount of experimental and research work foreshadowed the modern radio vacuum tube

De Forest started the ball rolling when he put the vital third electrode into the simple, two electrode Fleming valve. His invention opened the gateway to radio as we know it today, but it has taken thousands of research workers literally millions of hours to bring the tube to its present state of performance.

Not long ago we were paying nine dollars for a type 201 vacuum tube that was not nearly so good as the tubes of today and drew one ampere of current to light the filament! All the change that has been made in this vital part of the radio broadcast receiver—and consequent improvement in radio reception—we owe to careful, painstaking research It has cost one of the biggest tube manufacturers in this country a staggering sum—millions of dollars—for research in order to bring their tubes up to the present point of efficiency, and this concern still has sixty-eight engineering specialists at work on further experiments.

AS A result, we have today, for example the new 230 type battery tubes which are on a par with the 201-A and 227 tubes for reception results and use only one-eighth of a watt of power on the filament —just one forty-eighth of the power needed to heat the old 201!

As to AC tubes, we started out using the 226 and 227 heater type tubes. The 226 produced too much hum. The 227 burned out too quickly. The research departments of the various tube manufacturing concerns got busy on the problem and today the 227 represents one of the most durable types of tubes that we have It has, in fact, replaced the 226 for all purposes. The same may be said to a somewhat lesser extent of the 224 screen grid tube which, because of its more elaborate construction, still presents many problems.

Rectifier and power tubes also have been greatly improved, particularly in their power handling ability and their durability

In the case of heater type tubes, slow heating was a serious problem that engineering and research departments had to solve. They worked for some time and finally were successful in producing a quick heater type of equal merit in other respects to the slow heater tubes. Early types of quick heater tubes were, in some cases, durable enough and otherwise satisfactory but had a decided hum. Now this bad feature has been ironed out and we have quick heater tubes that are satisfactory in all respects.

FUTURE changes in radio vacuum tubes are hard to anticipate with any accuracy, but it seems logical to expect a steady improvement in quality and a gradual lowering of prices. The constant effort in tube development laboratories is to make tubes more durable by improving materials and mechanical design. The average tube today has a considerably longer life than tubes sold a year ago and last year's tube was decidedly better than tubes of the previous season. The eventual radio vacuum tube, it is expected will be close to everlasting and function about as many years as a set would be used

AS FAR as making tubes that would provide better reception is concerned, little work has been done lately along this channel since tubes, as now made, provide all usable amplification. But there are many developments under way in tubes decidedly different from those in use today. Such tubes will not make possible improved radio reception but will permit the use of fewer tubes in a set. Just how soon and how extensively these tubes will be used depends on the attitude of the public

At present, the tendency of the radio buyer is to judge a set by the number of tubes rather than by the performance of the set as a unit. The 224 tube, which was developed with the idea of cutting down the number of tubes, has never been used to the fullest extent because buyers demand multi-tube receivers and manufacturers must put in an unnecessary number of tubes to make their sets sel-

Behind the modern vacuum tube stands the research laboratory It is responsible for our powerful, long lived tubes and the greatly improved radio reception they have made possible.

THE FOURTH OF A SERIES OF ADVERTISEMENTS DEALING WITH ULTRA-VIOLET RADIATION IN THE HOME.

Questions *and* Answers

about the GENERAL ELECTRIC SUNLIGHT MAZDA LAMP

Question Why do we have "sun starvation" in winter?

Answer Because no matter how brightly the winter sun may shine, it contains only a very small percentage of the normal beneficial ultra-violet found in summer sunlight. This is due to the fact that in winter the sun is at relatively low altitudes, and consequently the sun's rays must penetrate a greater mass of atmosphere to reach us.

• • • •

Question Why does General Electric in its advertising stress the need of ultra-violet for growing children?

Answer Because ultra-violet radiation develops Vitamin D - the sunshine vitamin. This is the anti-rachitic vitamin and during the pre-natal and the growth years of life, *it is an absolutely essential element for building strong bones and for sound healthy development*

• • • •

Question What about older children and the "grown-ups" of the family? Can they benefit by ultra-violet radiation?

Answer Every member of the family needs sunlight. Though ultra-violet rays penetrate the skin no deeper than the thickness of this sheet of paper, they work deep changes through the entire body. They aid in maintaining health by building up resistance to disease.

• • • •

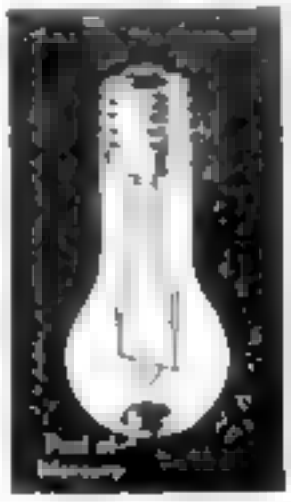
Question Why does General Electric emphasize the safety of its G. E. Sunlight MAZDA Lamp (Type S-1)?

Answer Because the bulb of the G. E. Sunlight MAZDA Lamp is made of special glass which filters out, as does the atmosphere in Nature, nearly all radiation not found in the best summer sunlight.

• • • •

Question How does the G. E. Sunlight MAZDA Lamp differ from the ordinary MAZDA Lamp?

Answer Though it embodies the simplicity and economy of the modern MAZDA Lamp, the G. E. Sunlight MAZDA Lamp differs markedly from the incandescent lamp in the following respects. It contains a pool of mercury (see illustration) a part of which vaporizes when the filament heats and forms an arc between the two button-like electrodes. Secondly, it will not fit the ordinary lamp socket, not only because its base is larger, but because a transformer is required to adapt the voltage in your home to that required by the lamp. Standards or fixtures designed for the use of the G. E. Sunlight MAZDA



Mercury is one of the most important and unique features of the G. E. Sunlight MAZDA Lamp. It not only gives a... it forms a small free pool of this element. When the lamp burns it lights a portion of the mercury to vapor and an arc is formed between the electrodes just above the V of the filament. This arc furnishes the ultra-violet rays so necessary to growing health

But the G. E. Sunlight MAZDA Lamp adds safety to ultra-violet efficiency by carefully filtering out, by means of a special glass bulb, practically all radiation not found in the best midsummer sunlight.

Look for the pool of mercury when buying any sunlamp equipment as well as the General Electric Trademark (GE) on a coil.

Lamp are made by General Electric and a number of other manufacturers and are offered for sale at your nearest electrical or department store.

• • • •

Question May the G. E. Sunlight MAZDA Lamp be used as a reading lamp or for other lighting uses?

Answer Yes, indeed. Not only does the G. E. Sunlight MAZDA Lamp give an unusually fine light for reading, sewing, and similar occupations, but each member of the family may be irradiated as he goes about the ordinary pursuits of the day. Children may be irradiated as they dress in the morning. Men may shave under this "sunlight." Women find the G. E. Sunlight MAZDA Lamp the ideal sewing light. Its soft, warming radiance is equally desirable for relaxation. Adults often like to "treat" themselves while reading in bed.

• • • •

Question Because of these many additional advantages, is the G. E. Sunlight MAZDA Lamp lacking in ultra-violet?

Answer Decidedly not. At a distance of three feet the G. E. Sunlight MAZDA Lamp provides the same ultra-violet effectiveness as is found in mid-day, midsummer sunlight

• • • •

Question What does the medical profession think of the General Electric Sunlight MAZDA Lamp?

Answer Ask your family physician. The General Electric Sunlight MAZDA Lamp is sold in accordance with requirements of the Council of Physical Therapy of the American Medical Association. Many physicians are prescribing units using this lamp, for shut-ins, pre-natal cases, and children, as well as a tonic for well people—that they may remain well.

• • • •

Question Where may I learn more about the G. E. Sunlight MAZDA Lamp and its many advantages?

Answer By writing to the Incandescent Lamp Department of General Electric Company, Nela Park, Cleveland, Ohio, or by visiting your nearest department or electrical store, or local lighting company

THE INCANDESCENT LAMP DEPARTMENT OF GENERAL ELECTRIC CO., NELA PARK, CLEVELAND, O.

Please send me, without any obligation, full information about the General Electric Sunlight MAZDA Lamp

Name

Address

City

GENERAL ELECTRIC
SUNLIGHT MAZDA LAMP

Join us in the General Electric Program, broadcast every Saturday evening over a Nation-wide N. B. C. Network

Our Readers Say

Here Is One for You Rain Makers

HAVING just gone through the worst drought in the history of Arkansas, I have been doing a lot of thinking about the possibility of the recurrence of it year after year. Here is an idea I have but I am not able to put it into practice and so I am sending it to you to turn over to someone who can do some experimenting with it. Take several gallons of liquid air to a height of 5,000 feet in an airplane and then spray it out. The liquid air, as it returns to a gaseous state, will take up a lot more room and will also lower the temperature of the air all around it. This should cause condensation of moisture to take place and produce rain. It might be found that the height at which the liquid air was liberated should be more or less than 5,000 feet. However, I believe the idea is worth a trial and I should like to see some one adopt it if possible. It would surely be worth the trouble if it succeeded in ending these expensive droughts.—H. A. H., Booneville, Ark.

Are Ultra-Violet Rays Good for the Eyes?

YEARS ago when I was a boy a few old people wore spectacles with lenses made of pebble. Later I learned that pebble is clear crystal or clear quartz. The advantage claimed for these glasses was that they did not scratch from frequent cleaning as ordinary glass lenses may, and the wearers used to say they were "cool on the eyes." Now it occurs to me that, as glass cuts out ultra-violet rays, those who wear glass lenses are, as far as their eyes are concerned, largely deprived of the ultra-violet rays. Whether this is a good or bad thing, I do not know. Lenses of fused quartz would allow these rays to pass through. Such lenses would be much more expensive than those of glass, as fused-quartz is a very hard substance, but maybe the expense would be justified if their other characteristics are as described.—C. L. W., Sykesville, Md.

Magic Door Opener Worked 37 Years Ago

AS I READ an article about self-opening door in a recent issue of POPULAR SCIENCE MONTHLY, I could not help smiling at the thought of how far behind the times you are. Along with hundreds of thousands of other visitors to the World's Columbia Exposition in Chicago, in 1893, thirty-seven years ago, I walked back and forth through a similar door which opened instantly as soon as one stepped on a rubber mat, one of which was on either side of it. One just stepped on the mat, walked through, and the door closed behind him. Photo-electric cells were not even dreamed of at that time.—J. N. R., Chicago, Ill.

Begs for Return To Old Covers

I JUST got my POPULAR SCIENCE MONTHLY for October today and saw the cover page. Why don't you keep on with the old cover? For the last five years I have been taking POPULAR SCIENCE MONTHLY and think that it has everything else skinned, but please go back to the old covers because they are nice in a bound book.—E. E. A., Toronto, Can.

Telling Government Experts How to Do It

IN YOUR October issue on page forty-six appears the article, "We Have Found a Way to End the Mississippi Floods." After reading this article I fail to see where an end of the floods is likely to result, as the aim of the present work is simply to curb the floods, at an enormously high cost, and leave the danger ever present. Really to stop floods the Government should erect dams in the upper Missouri River and so hold the crest of all floods to the Missouri valley. This would save much valuable land along the Missouri that now is lost each year. Also these dams could generate electricity and the water held back could be used for irrigation purposes in Dakota, Colorado, Kansas and Nebraska. To remove a bad effect, remove the cause, and since the Missouri is the cause, flood work should be done there. This I think is obviously essential if any real and definite success in flood control is to result from their enormous expenditure.—S. R. S. Copeland, Kan.

Just Discovered This Is a Great Age

AN ELDERLY gentleman to whom I sent POPULAR SCIENCE MONTHLY writes me: "We enjoy reading POPULAR SCIENCE MONTHLY very much. It is so thorough and yet so plain. I had no idea of the number of great things now being done. We surely are living in a very progressive age."—J. S. D., Chicago, Ill.

Bird's Weight All Depends on the Cage

CONCERNING that "Bird in the Gilded Cage" problem presented by Miss N. O., Piedmont, Calif. I do not have an air-tight cage at hand so I cannot test my opinions experimentally, but I am convinced that she would encounter two different results in the scale readings dependent on whether she used an ordinary wire cage or a hermetically sealed one. If the bird flew off his perch in the ordinary cage the scale would at once indicate its loss of weight, because the beating of the bird's wings upon the air would immediately dissipate the gravity pull into cross currents of air which would be lost in the outer atmosphere. In the case of an air-tight cage the bird's weight is simply added to the air's weight and through it transferred to the floor of the cage itself. The total downward pull on the scale is unaffected.—A. E. W., Ada, Ohio.

Wants a Grasshopper to Ride to Work

HERE is a suggestion for one of your many readers who are mechanical geniuses. Let him study the mechanism of the grasshopper, until he is sure he knows exactly how it works. Then the thing for him to do is build a mechanical hopper in which I can sit and hop to town. In such a contrivance, I could skip gaily over streams and fences and railroad tracks instead of being obliged, as at present, to go all the way around over the winding and congested highway. Sound good to you? And surely the mechanical difficulties won't stop the experts who study "Our Readers Say."—M. McA., Cincinnati, Ohio.

Broadminded but Likes His Models

I WAS glad to read the letter in "Our Readers Say" by C. B. of New York in which he asks you to publish plans for a modern destroyer, which I see you are already publishing, and which I intend to build. I have built your Spanish Galleon and the *Sovereign of the Seas*. I am getting the plans for the *Sovereign of the Seas* enlarged so I can build a second twice as large as the first. Here's for more of everything and less of the fellow who says, "More of the department I like and less of the department that the other fellow likes."—D. W. M., Lansdowne, Pa.

Passenger Pigeon Is Alive Again

I WAS interested in reading a recent issue of your magazine that certain people in Michigan had reported seeing what they believed to be passenger pigeons, supposed to have become extinct years ago. I saw passenger pigeons in my boyhood, fifty years ago in Ontario. About a month ago, I was driving through an Indian reservation near here and was amazed to see a band of pigeons quite different from the ordinary wild pigeon known in this country. There were fifteen or twenty of them. Because of their long bodies and necks and tails, they had the exact appearance of the

passenger. Some lit in trees, but too high for me to make out their coloring. At the time I felt sure they must be passengers, and since reading your article I am convinced they were the lost birds.—W. A. R., Campbell River, Ont.

You Women Smokers, He's After You!

ONE thing I would like you to do, and that is carry on an investigation into whether cigarette smoking by women will result in ill health for the future children of this great land of ours. This I think would make an article well worth publishing and which I believe would provide much food for thought. You can send out questionnaires to prominent physicians, biologists, chemists, and others who may deal with the physiology of the human system. I shall look forward to a favorable reply as I am sure you will take action to give us this very desirable article.—T. G. E., Fort Wayne, Ind.

More and Different Models Requested

FOR THE past three years or more I have been reading your "Our Readers Say" Department. I, personally, have had no fault to find with POPULAR SCIENCE MONTHLY and still have none, as I think that it is well divided up. But here is a request that I have: Give us some modern models to shoot at for a while, such as destroyers, battleships, submarines, engines, and so forth. I don't mean to stop the models that you are running now, but give us something different once in a while. Hoping that this will at least cause you to consider it.—T. N. S., Hagerstown, Md.

Do You Also Want More on Chemistry?

I QUITE agree with R. H. B. of Philadelphia and J. D. F. of Carlisle, Pa., that we should have more articles on chemistry. I would also include physics and mathematics. Practically none of our modern inventions would have been possible without the application of the principles of chemistry, physics and mathematics. This is an age of "Science" and the very word implies the use of these subjects. Undoubtedly those interested in aviation and radio would also be interested in the laboratories where the "Modern Wizards of Science" carry on their research. The knowledge of the scientific method of work can be used in any line. The puzzle solvers would derive plenty of satisfaction out of tussling with the mathematical problems of chemistry and physics and those without technical training need not fear most chemical problems. Here's to many articles of such a nature.—O. L. C., Seattle, Wash.

A Bouquet from Switzerland

LET ME congratulate you on the manner in which you edit POPULAR SCIENCE MONTHLY. I never read your magazine without pleasure and profit and it seemed to me it was only right and courteous for me to let you know how I feel about your publication.—M. U. S., Zürich, Switzerland.

Gus and Joe Helped Him Get a Reputation

SEVERAL years ago I read in your magazine about a Mr. Spratt and the trouble he had with his car. The other day my car acted much the same as his and I immediately knew the trouble was in my vacuum tank. I read your magazine and like the "Gus and Joe" articles. P. S.—My wife thought I was quite smart.—J. R. O., Detroit, Mich.

Complaints Have "Riled" This Reader

I'M TIRED of hearing folks complain about so many articles on airplanes. If you had only a cover design by Paus and a picture of an airplane inside, I would buy your magazine, and more than get my money's worth.—H. S., Bowie, Texas.

He Heads Crusade to Exterminate Autos

YOU MAY put me down as a double-dyed, ring-tailed, simon-pure grouch with an ailing liver if you want to, but when I read in your December issue, "Flops of Famous Inventors," I said to my wife, "I wish more of them had flopped!" Take that great invention, the automobile. What did it do for its country last year? It killed about 25,000 useful citizens! And that doesn't count the ones that died in bed from fatty degeneration brought on by riding on soft seats instead of walking as we did when I was a boy. Imagine what we would think if we heard of some distant country in which wild beasts roaming the roads killed 25,000 citizens a year. We wouldn't go there for love nor money. We would wonder why the entire population didn't rise up and wipe out the beast. Well, if we weren't so familiar with the automobile, we would rise up in an army and exterminate it as the public menace that it is. I suppose a lot of your readers will come to the defense of the auto but I'll bet they can't show that it has done more good than it has harm.—J. S., St. Louis, Mo.

Has Ideas of His Own about Engines

I AGREE with W. R., New York City, about locomotive models. The ones he writes about are fine, but how about the new 4400 class of passenger engine on the Baltimore and Ohio R. R.? Especially the 4403, one of the engines that hauls the "Capital Limited?" I think it is a neat looking engine and, with the new type tender, it would make a splendid model.—G. F. S., Jr., Cumberland, Md.

Makes Santa Maria In 140 Hours

JUST completed the "*Santa Maria*" model from your blueprints. Everybody who sees it says it is the most detailed model they ever saw. Material cost about $1.35; every part of it is made with hand tools, used old cigar boxes, fruit baskets, etc., on same. Took about 140 hours of spare time to make it. This included all blocks, deadeyes from large size of wood by ripping, and filing same down. Lot of work, but I enjoyed it.—M. R. P., Chicago, Ill.

Hurries to Defend Nice Bus Drivers

I HAVE just read what A. C. of Erie, Pa., had to say about bus drivers. Recently I made a coast-to-coast trip by bus from Los Angeles to Baltimore. During good weather the drivers are forced to exceed the speed limit in order to keep up to their schedules. I found most of the drivers were very careful, especially in passing other cars and in crossing railroad tracks. I noticed that the bus drivers in the West were much more human and accommodating than those of the East. Several times I have seen them stop to offer assistance to motorists in trouble and twice they actually pulled stranded cars out of ditches. I hope these facts will help to clear up some of the points mentioned by A. C.—R. E. E., Baltimore, Md.

Careful Reading Avoids Blunders

IN YOUR article on the velocity of light, there is the implication that up to now the figures used have been based on guesswork and approximation, grouping two vastly different terms as though they meant the same thing. How could anyone guess at such a quantity as the speed of light? Secondly, it is stated that Dr. Michelson expects to obtain new figures that are absolutely accurate. I fully believe such a statement is ridiculous and photographically absurd, although printed in a highly respected scientific magazine. Isn't it true that if the value in question were carried out to a million or a million-million decimal places, it would still be an approximation? Isn't it impossible to measure anything with absolute accuracy?—W. J. H., Hyde Park, Mass.

"Guesswork" and "approximation" were used with reference to astronomical measurements and "absolutely accurate" was applied to the implement scientists would have to work with if Dr. Michelson succeeded in establishing the exact speed of light. Which after all is decidedly different from the significance you gave the words.—Editor.

J. E. N., Does This Answer Your Cylinder Problem?

IF J. E. N., Durango, Colo., wants accuracy in his question about the two-inch hole bored crossways through a two-inch cylinder, he will have to go into calculus. The following answer, however, gives approximate results. The cylindrical section of the rod two inches in diameter and two inches long contains 6.2382 cubic inches. Since the boring is perpendicular to the axis of this cylinder, and its diameter coincides both with that altitude and diameter of the cylinder itself, the material removed from it will be approximately .7854 of the volume of the cylinder itself.—A. E. W., Ada, Ohio.

His Frozen Fish Came to Life When Thawed

SOME thirty-odd years ago I was staying at my sister's home just south of Battle Creek, Mich. One day a young fellow invited me to go down to the lake and spear speckled bass through the ice. This we did. I noticed how quickly they froze, it being some fifteen below. Arriving at the house we put them in water and the majority of them were soon splashing about, as well as ever. I've never thought so much of this as it is more or less common knowledge among us common herders. I was surprised that you were surprised concerning the article by John Chapman Chilcer.—F. J. C., Medford, Ore.

Their words have wings as swift as light

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We live and work as no other people have ever done. Our activities are pitched to the swiftness of the instantaneous age.

Whatever happens, wherever it happens and however it may affect you, you may know it immediately over the wires or the channels of the air that carry men's words with the speed of light. Business and social life are free from the restrictions of time and distance—for practically any one, anywhere, may at any time speak with any one, anywhere else.

The widespread and co-ordinated interests of the nation depend upon an intercourse that less than sixty years ago was not possible in a single community. This is the task of the telephone wires and cables of the Bell Telephone System—to make a single community of our vast, busy continent wherein a man in Los Angeles may talk with another in Baltimore or a friend in Europe as readily as with his neighbor.

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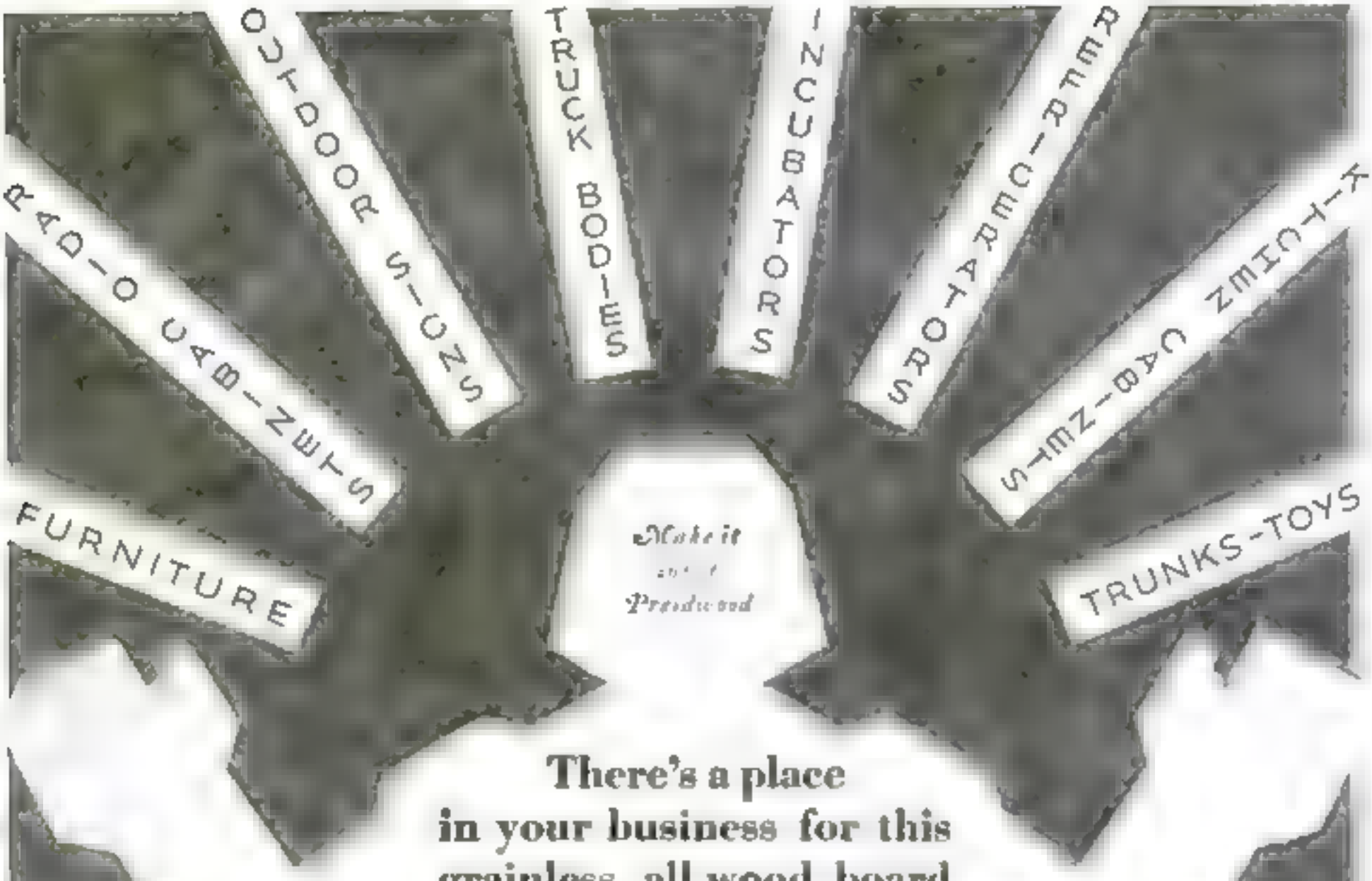
To this end, its construction program for 1930 has been the largest in its history. This System at all times accepts its responsibility to forward the development and well-being of the nation.



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Popular Science
MONTHLY

JANUARY, 1931 RAYMOND J. BROWN *Editor* VOL. 118, NO. 1

Secrets *of the* Fortune-Telling Racket

Efforts to Dip into the Future Cost Americans $125,000,000 a Year—Tricks Used to Fool "Suckers" Explained Here

By MICHEL MOK

VICTIMS of a wave of superstition such as the world has not seen since the Middle Ages, the people of the United States are paying $125,000,000 a year to an army of 100,000 fortune tellers of all kinds, including crystal gazers, astrologers, numerologists, palmists, phrenologists, card manipulators, tea-leaf readers, and other charlatans who infest the country from one end to the other.

In New York City alone, more than $25,000,000, a sum equal to the total city budget of Pittsburgh, Pa., is spent annually by the gullible for the privilege of listening to the vague, valueless, and often ominous predictions of between 15,000 and 20,000 soothsayers who are active there in defiance of the law.

The yearly harvest in Chicago is about $17,000,000, half of which is contributed by local believers and the other half by mail order customers in a territory extending as far as Kansas City. Other localities are duped in various proportions, depending on popular credulity, stringency of the laws, and the rate of taxation levied upon the tricksters.

These are a few of the amazing facts brought to light by John Mulholland, vice president of the Society of American Magicians, in an investigation of the fortune telling racket he recently conducted. Compared with the present-day dealers in fake prophecies, he found, the bearded, cone-hatted diviners of medieval times were a set of bungling amateurs. The modern Merlin's business methods are as efficient as his forecasts are spurious.

For example, one woman astrologer doing a thriving business in New York, Mulholland told me, charges her clients according to a sliding scale of fees ranging from $25 to $500 for a reading. Her income from mail orders alone is $20,000 a month. Another star gazer, a man, with headquarters in Chicago, has one hundred customers, all of them substantial business men, who pay him $1,000 a year each for a monthly business horoscope.

Supposedly an individual message based on the movements of the stars, this expensive revelation, Mulholland discovered, simply is a form letter sent out with a cheerful disregard of the client's particular business. In other words, a farmer and an ice cream manufacturer, say, who happen to have been born in the same month (and hence under the same planet) will receive identical "business forecasts."

Mulholland shows the author how a fortune teller, by deft trickery, causes a personal message to appear suddenly on a blank slate which the customer will swear never was out of his hands.

supernatural. In this frame of mind, they are easy prey for the charlatans. The

While the soothsayer chats with the visitor his accomplice gets the necessary information, writes it on a card and slips it into a panel as shown in artist's drawing at upper left.

...or one dollar. At the same ... book is offered for a dollar, ... scope for a dollar, and a set of ... for a dollar.

... his first invitation, this man ... letters from radio listeners ... Then his staff of secretaries ... ing out the "come-on" letters. In reply to these, thirty percent, or ...,000 sent from one to four dollars, ten ..., or 10,000 mailing the entire $4.

The horoscopes and dream books are furnished by a supply house in Chicago, ... sells the books that retail at $1 for three cents a piece when bought in bulk. Mulholland, who saw the card file of this wholesale dealer in occult paraphernalia, told me it contained the names of more than 1,000 fortune tellers in all parts of the United States.

As for the soothsayers' methods, these vary according to the tastes and social standing of their clientele. The fortune seeking public dictates the hokum accompaniment to the predictions it buys. Whether this takes the form of peering at an astrological chart, staring into a fire-bowl in which you believe the paper bearing your questions is burning, playing with cards, reading your palm, gazing into a glass ball supposed to be a crystal (which would be worth from $60,000 to $75,000 if it were real) or "interpreting" the mess of leaves at the bottom of your teacup, it may be ...

... ut, like hats, they remain the same in essentials. ... pseudo-science is the style among the ... educated cus-

... nevertheless, have found it to be a fact that literally millions of Americans, a good share of whom own radios, look upon the workings of radio as supernatural manifestations.

If you can send a voice around the world, through the air and catch it again with a mechanical device, they reason, why should it not be possible to hear voices from the Beyond? If the astronomer can foretell the time of an eclipse to the minute and second, why can't an astrologer forecast future events in a person's life? If Einstein is honored for his fourth-dimensional hypothesis, what is wrong with the spiritists who claimed to have discovered a fourth dimension long ago?

"These are some of the arguments of the scientifically ignorant, and even the most intelligent men in business sometimes are ignorant of things scientific. The fact that a man is an expert in his field does not necessarily mean that he knows anything outside of his own line."

Speaking of radio, this development of modern science is being used widely by the fortune tellers, especially the astrologers and numerologists, in the furtherance of their pseudo-scientific racket.

More than 100 broadcasting stations in the country innocently are helping to promote a shady business. They permit the soothsayers to lecture on the air to prospective customers, either as a "sustaining feature," meaning one given gratis to the broadcasting company in return for

Did "Health Rays" Create Life?

Origin of Living Matter May Be Traced to Ultra-Violet Light Now Used In Treating Diseases

By GEORGE LEE DOWD, JR.

S

A symbolic drawing suggests sunlight's power

materials of which living cells are made. Presently these mysterious substances were stirred into life, and the original ameba, the tiny, one-celled ancestor of all living things, was born.

That, in substance, is the picture of the birth of life on earth recently presented by Dr. Irving S. Cutter, dean of the Northwestern University Medical School.

In the light of this new theory, all the experiments made with natural as well as arti-

Dr. J. W. Marden, research engineer, demonstrates the ultraviolet and incandescent-giving bulb that has recently been developed.

ficial ultraviolet rays, which have aroused the interest of the medical profession and laymen alike for several years assume a hitherto undreamed of significance.

Nowadays, men, women and children are in almost continual pursuit of the beneficial ultraviolet ray. A coat of tan has become the fashion, and sun-tan bathing suits and sun-tan frocks have replaced parasols and protective apparel.

Comparatively few, however, are in a position to follow the sun through the seasons. Hence the popularity of "artificial sunlight," produced by a large variety of lamps. Some of these devices generate rays that approximate those of the sun, others have no more medical value than an ordinary electric light bulb. The two principal genuine types are the mercury vapor lamp in various forms and the carbon arc (P.S.M., April '29, p. 27).

ON THE basis of the constant improvement in "sunlight lamps" it was predicted not long ago that, some day, we would live and work in buildings without windows. And a windowless world has been brought a little nearer by the invention of new ultraviolet lamps that provide health rays and illumination.

Two large electric companies have developed [illegible] similar in appearance to an ordinary household lamp bulb. At a distance [illegible], they are said to produce a tan as quickly and as thoroughly as the summer sun.

Within each of these bulbs is a [illegible] filament supplying ordinary light. There is also a small pool of mercury at the bottom of the bulb. When the current is turned on the mercury turns to vapor and a mercury-vapor arc glows between two tungsten electrodes hanging inside the bulb. About sixty-eight percent of the light comes from the glowing electrodes, twenty-five percent from the arc and the remaining seven percent from the filament.

THE new lamp's advantages are obvious. The present carbon arc is a large unwieldy affair. The mercury vapor lamp, also rather cumbersome, gives the harsh greenish light seen in some photographic studios. Still, we shall probably have windows for quite a while to come.

The first of the new "sunlight" bulbs to be placed on the market, designed by General Electric engineers, does not fit ordinary household sockets and cannot be operated on house wiring without special apparatus. Another type, developed by Westinghouse research workers, is connected to an ordinary lamp in a twin socket, and may then be placed in a household outlet. This bulb is undergoing tests, but may not be placed on the market for some time.

Sunlight was believed by several ancient peoples to have a beneficial effect on health. The Incas of old Peru worshipped the sun as the source of all life, antedating by centuries the latest scientific confirmation of this idea. But, though scores of investigators in several parts of the world have conducted countless experiments, the sum total of exact knowledge about the nature and effects of ultraviolet [illegible] is small. If Dr. Cutter's theory is substantiated, it may be expected to help solve the mystery.

WHAT are ultraviolet rays? Sunlight which seems yellowish white or golden to us, really is a blend of many colors. These can be seen by passing it through a glass prism when it forms the rainbow-like color-band, violet at one end and red at the other, which is called the spectrum. But the sun also emits invisible rays—the infra-red, or heat-giving kind, and just outside the red end of the spectrum, and the ultraviolet, which lie outside the violet end. These are the skin-tanning, health-giving rays.

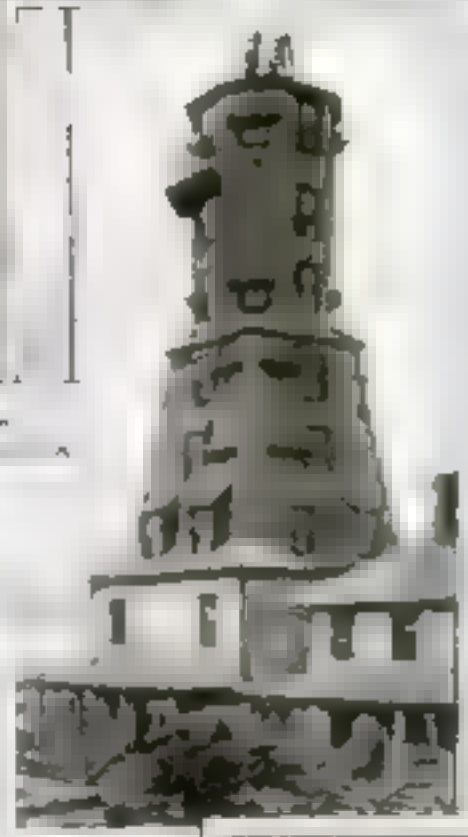
It is a proved fact that ultraviolet rays cure rickets. There also is no doubt that they promote growth. Only a few weeks ago, Dr. George R. MacGhan, of Cornell University, Ithaca, N. Y., announced the result of a test he made with two groups of chicks. One group, raised under ordinary electric light bulbs, grew to only half size, became deformed, and finally died of rickets unless given special care. The other group, living under electric light bulbs of glass transmitting ultraviolet, grew to full size. Moreover, the chicks suffering from rickets were cured by the small amount of ultraviolet emitted by the ordinary tungsten filament bulb.

WHILE generally agreed on the antirachitic, or rickets-preventing or curing, and growth-promoting qualities of ultraviolet light, medical authorities are somewhat divided as to its curative and preventive properties in other diseases.

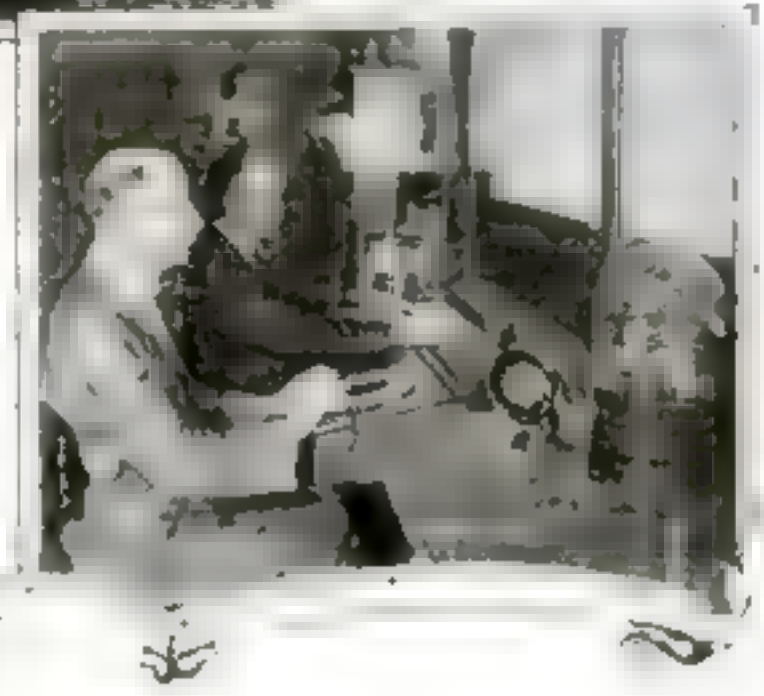
The opinion of the majority was reflected in a recent statement, from experts of the United States Public Health Service, who said that light has been found beneficial in certain forms of anemia, malnutrition, tuberculosis of bone, joints and glands, for the cure of wounds and ulcers, and for the relief of congestion, and neuritis. (Continued on page 136)

Ships Identified 30 Miles Away

This card shows the distinguishing marks of the Leviathan.



The observer at Highlands, N. J., is the first man on land to see the incoming ships. When he is sure of the liner, word is flashed by wire to New York. Other observers at similar towers in harbor report ship's progress.



As word of an incoming boat is received here, a central office spreads the news.

FIRST man on land to see the Atlantic liners come in is an observer with a telescope in a Highlands, N. J., tower overlooking the sea. For thirty-three years, Samuel F. Phillips has scanned the horizon for masts and smokestacks. When he mentions an incoming vessel, he turns to a Morse key and telegraphs the news to New York.

He is a part of an organization that serves a million Americans each year, though few strangers even know of its existence. This bureau, known as the Western Union Marine Service, lets New York know through instruments exactly like stock tickers when all liners are docking.

Many of the tickers are located in the service's own branch offices throughout the city. Messengers hurry out, every few minutes, to notify individuals who have called up and asked to be told when a particular ship is docking. Thus a business man who wishes to meet an incoming friend can be on the dock at just the right time, avoiding minutes or hours of waiting. Steamship lines, hotels, and taxicab companies have installed private tickers in their own offices, to be kept informed of the movement of all ships.

Diagrams of the kind shown above show how a ship looks in daylight, darkness, or in fog.

HOW does the system work? When Phillips, at his Highlands tower, spots a ship on the horizon, he turns to a box of index cards. Each bears a picture of a ship and points out its distinguishing marks. No two ships are exactly alike in appearance. By comparing the card with what he sees in his powerful telescope, Phillips recognizes vessels while they are still thirty miles away.

When he taps his telegraph key, a sounder clicks in an office in the Western Union building in New York, where two men sit side by side. One copies down every message in a ruled "log book." The other peers over his shoulder and turns to a device with a circular keyboard that resembles a typewriter. As his nimble fingers punch the keys, news of a ship's sighting goes out over all the ticker wires. It appears in every office on a standard piece of ticker tape.

Phillips is not the only observer. Others, in similar towers along New York harbor, report the progress of the ship toward the harbor. Years ago, the first observer to sight a vessel relayed the news to the next tower by moving a semaphore arm, and eventually the news thus reached New York. Now all observers report directly by wire to the New York headquarters, saving much time.

Each one has his own system of recognizing the ships. Phillips has a collection of pen-and-ink profiles, pointing out such distinguishing features as the arrangement of lifeboats and lighted portholes, the latter for identification at night. The observer in the 100-foot tower at Sandy Hook uses an elaborate collection of pencil sketches that serve in any weather. Four of them are shown at the lower left. The top one shows the ship in the daytime, and the second reveals how it appears at night.

To the trained observer, the small point of light farthest to the right of this drawing indicates a deck house near the stern. The remaining two pictures show the aspect of the same ship in low and high floating fogs.

Ermine from Your Own Back Yard

Costly Furs Can Be Imitated from Rabbit Pelts Grown in Private Hutches—Little Cash and Space Needed to Start Business

By H. H. DUNN

An idea of the size of domestic rabbits may be had from this picture in which one is held by a child

IF YOU want a new fur coat of any kind from ermine to seal, you may have it at one twentieth to one tenth the price you would pay for a genuine garment of the same size, color, and appearance

On any back yard space of 200 square feet or more, you may raise your own fur, prepare it yourself, and, if you are sufficiently skilful, make your own coat, cape, neckpiece, or whatever you want. Since a minimum area of 200 square feet in a strip twenty feet long by ten feet wide, most yards afford such space, and an original investment of $50, sometimes less, with spare-time work, mornings and evenings, will provide the women and children of any family with furs for all occasions.

The fur-producer is the rabbit, and, according to experts of the national and state governments, meat production from a small "herd" of well-selected and carefully maintained rabbits will more than pay all expenses, including the original investment. Thus the fur garments of the family become "velvet."

In England, full length coats of rabbit seal, sable, beaver, nutria, silver fox, and many others are being produced at $15 to $25 each, as compared with a cost for the genuine furs of the same color and appearance of between $500 and $1,500. In the United States the production cost is $5 to $10 a garment higher, but in this country is being produced a fur from one variety of rabbit that is the nearest known imitation of the almost priceless ermine.

American rabbit-raisers are producing many varieties of furs equalling in appearance the finest of seal sable, mink, martin, fox, or ermine. In fact, there seems to be no fur-bearing animal, no matter how rare, whose pelt cannot be imitated with rabbit skin if great care in matching and dying is used

Above, "Russian leopard" skin coat made entirely of rabbit skins and trimmed with Angora rabbit fur At right "Pacific seal" coat, made of rabbit skins and trimmed with Chinchilla fur

AMERICAN rabbit-growers, of whom there are more than 200,000, large and small, are marketing this year a rabbit that will weigh from sixteen to twenty pounds, and the twenty-five-pound rabbit is on the way. This means that such a rabbit, selling at fourteen to seventeen cents a pound for meat only, when one year old will be worth nearly twice as much as the present "meat-rabbit."

The fur on this large animal is soft, short but heavy and pure white, the ideal pelt for dyeing to any color or pattern of colors, and nearly twice as large as that of the celebrated Himalayan, the small, black-nosed, black-eared, white rabbit, from which "ermine" is produced. The grower who learns to raise these giants among hares will get his furs as clear profit, receiving from forty to sixty cents a pound for them

More than 100,000,000 rabbit skins are used in the United States every year forming by far the largest factor in the fur trade. One maker of men's hats consumes 100,000 rabbit skins every working day in the year. Of the total of these furs, approximately 55,000,000 are made into garments for women and children, after being clipped, trimmed to uniform size and dyed. The finest and most durable of the beautifully marked imitation "leopard skin" coats are made of white rabbit skins, mainly from the New Zealand or Flemish whites, carefully matched and then dyed and patterned to the ocellated markings of the leopard's hide

The remaining 45,000,000 or more skins go into men's and women's hats, linings for gloves, and occasionally into men's coats, overcoats, and jackets. In the making of hats, the fur is removed from the

skin and made into felt, the skin then being shredded and converted into glue. Indeed, there is little or nothing of the rabbit skin that is not commercially valuable, and the total consumption of the United States is valued at $26,000,000 every year.

BUT of this large number of rabbit skins not more than two percent are produced in the United States. Australia, New Zealand, France, Belgium, Holland and other European countries sell us ninety-eight percent, or more, of this ...000,000 annual output of ra... pay them approximately $2... for them.

Moreover, the use o... and demand for rabbit skins is increasing steadily, and the figures above given, those for 1928, are in all probability several hundred thousand dollars under the actual value of the pelts used in America in 1930.

This is not surprising in view of the fact that rabbit skins are now made up in imitation of a great number of the popular and expensive furs. These imitations bear trade names that, in general, suggest the fur they are intended to replace. Among the varieties now on the market are Arctic Seal, Baltic Back Fox, Baltic Leopard, Baltic Red Fox, Baltic White Fox, Coast Seal, Coney, Mole, Electric Beaver, French Beaver, French Sable, French Seal, Imitation Ermine, Near Seal, Northern Seal, Polar Seal, Red River Seal, Russian Leopard, Sable Hair and Squirrette. There are a number of others in the list which, complete, totals fifty-seven varieties.

BUT the American who wishes to have his or her own fur coat by next fall need not worry about these larger aspects of the industry. With the space available on the back of almost any city lot, the purchase of three or four full-grown female rabbits and the home construction of suitable hutches for them, the amateur fur-producer may have, in a year, any one or more of at least fifty-seven varieties of fur.

Climate is not an essential factor, though southern California has become the center of the American fur-rabbit industry. Contrary to usual ... tion necessary. If you want more, the division of fur resources of the Bureau of Biological Survey, of the United States Department of Agriculture, is fully prepared to show you just what rabbits to raise and how to raise them, wherever you may be located.

Every domestic rabbit—except the Angora, which produces hair instead of fur—is of value for its pelt. Though the hair of the Angora is used in the making of certain yarns and some cloths, it is not in wide demand, and as this is not a "meat rabbit," it may be eliminated from the consideration by the back yard rabbit raiser.

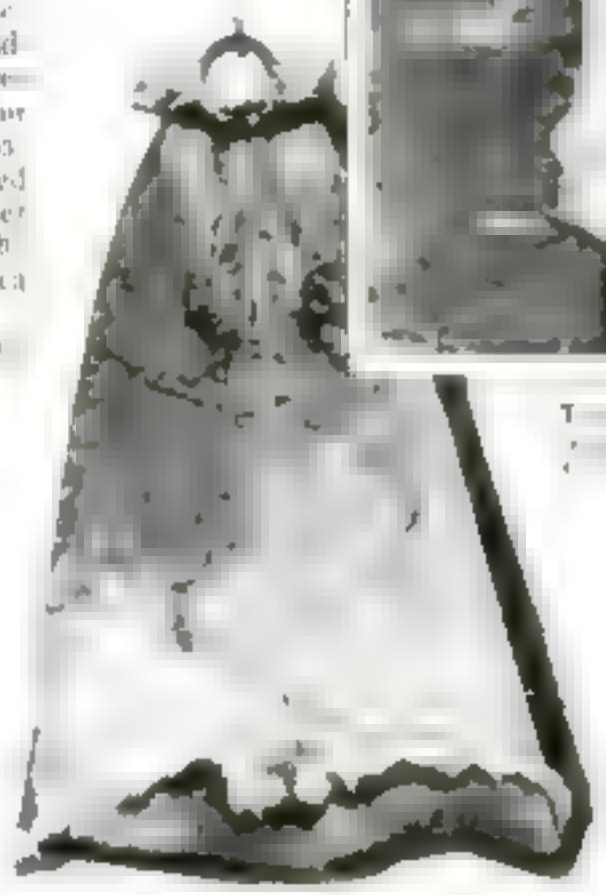
The first essential for the home fur producer is dry land and perfect drainage, for the great enemy of all rabbits is dampness. Next comes type of hutch—for domestic rabbits are not to be allowed to run free, no matter how large or well fenced the yard. Years of experiment have shown that the slat-bottomed, self-cleaning hutch is the best. The tier system, with three compartments one above the other, ... best provided abundant ... given with borough protection in and wind.

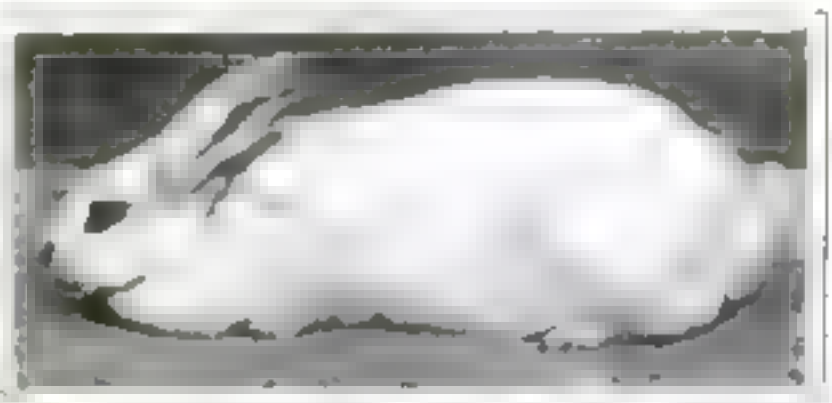
IN SOUTHERN California, where are ... from seventy to eighty-five percent of the domestic rabbits raised in the United States, the three-tier hutch is ... largely by the back yard rabbit ... State's rabbit men also sold ... more than $1,000,000 worth of rabbit meat in 1929, dressing about 20,000 of these animals weekly. It may be considered, then, that the methods developed in California are equal if not superior to those of any other group of rabbit raisers in the world.

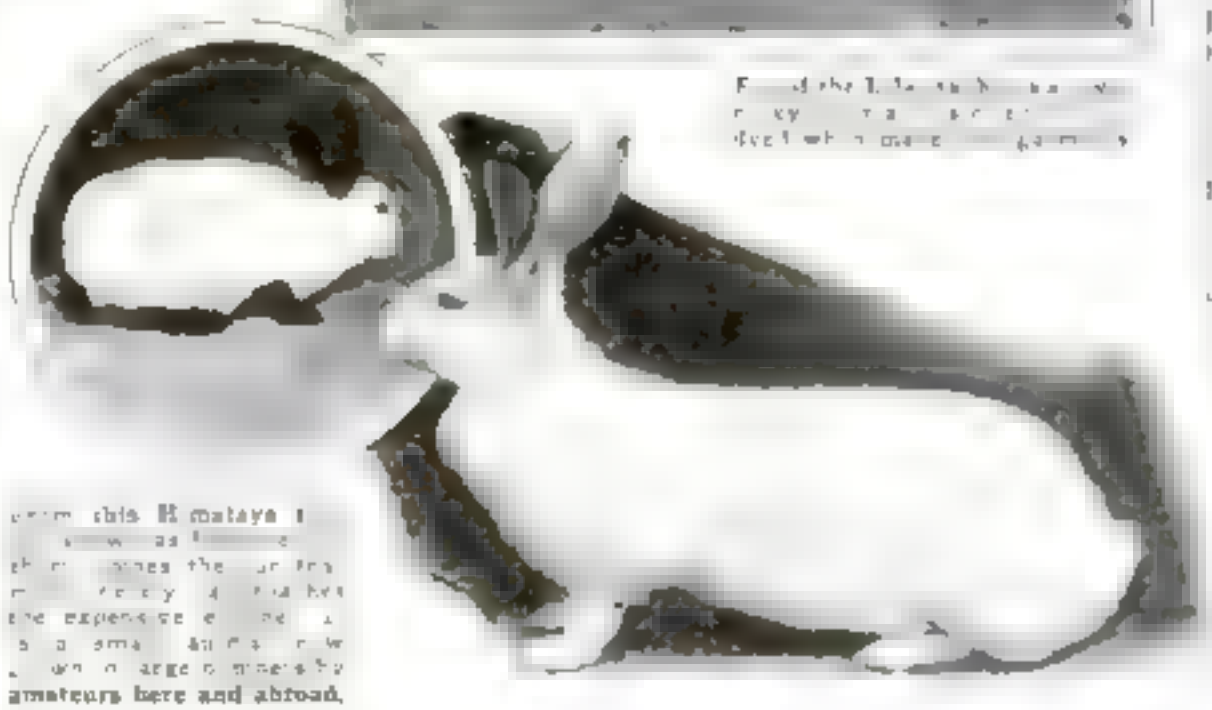
The back yard fur producer will find that his rabbits take more labor than chickens. Cost of feed, if bought at times of abundance and low price, ranges from $3.50 to $3.75 a year for each rabbit. Without charging off the labor of the owner, each breeding doe and her average yearly increase of twenty young rabbits will eat at about $12 worth of food. In large rabbitries a net profit of $5 a year on each breeding doe is considered fair; in rare cases, $10 to $12 a year is realized.

The back yard fur grower should start with three or four good breeding does, costing from $7.50 to $10 each. Now and again they can be obtained in the

(Continued on page 142)



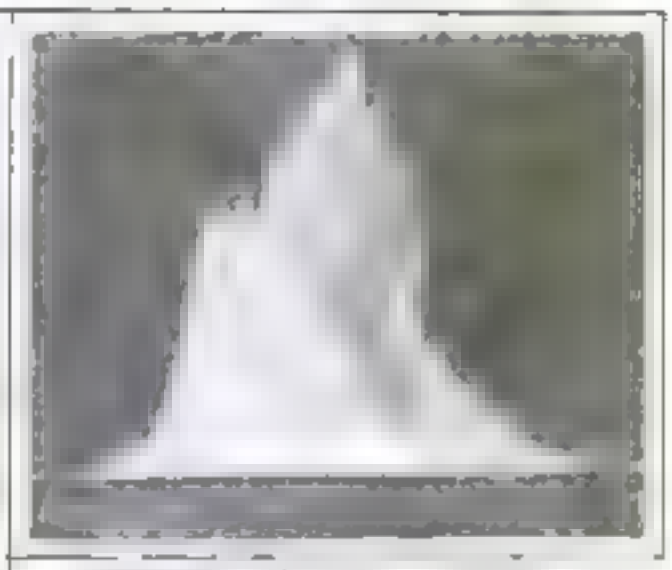




Dynamite Buries Wrecked Liner

NEARLY [illegible] had run aground, when the greatest undersea explosion in history recently rumbled beneath New York harbor. Fifty thousand pounds of explosives dug a grave for the [illegible] *Victoria*, which ten months before [illegible] the entrance to Ambrose Channel in New York Bay [illegible]

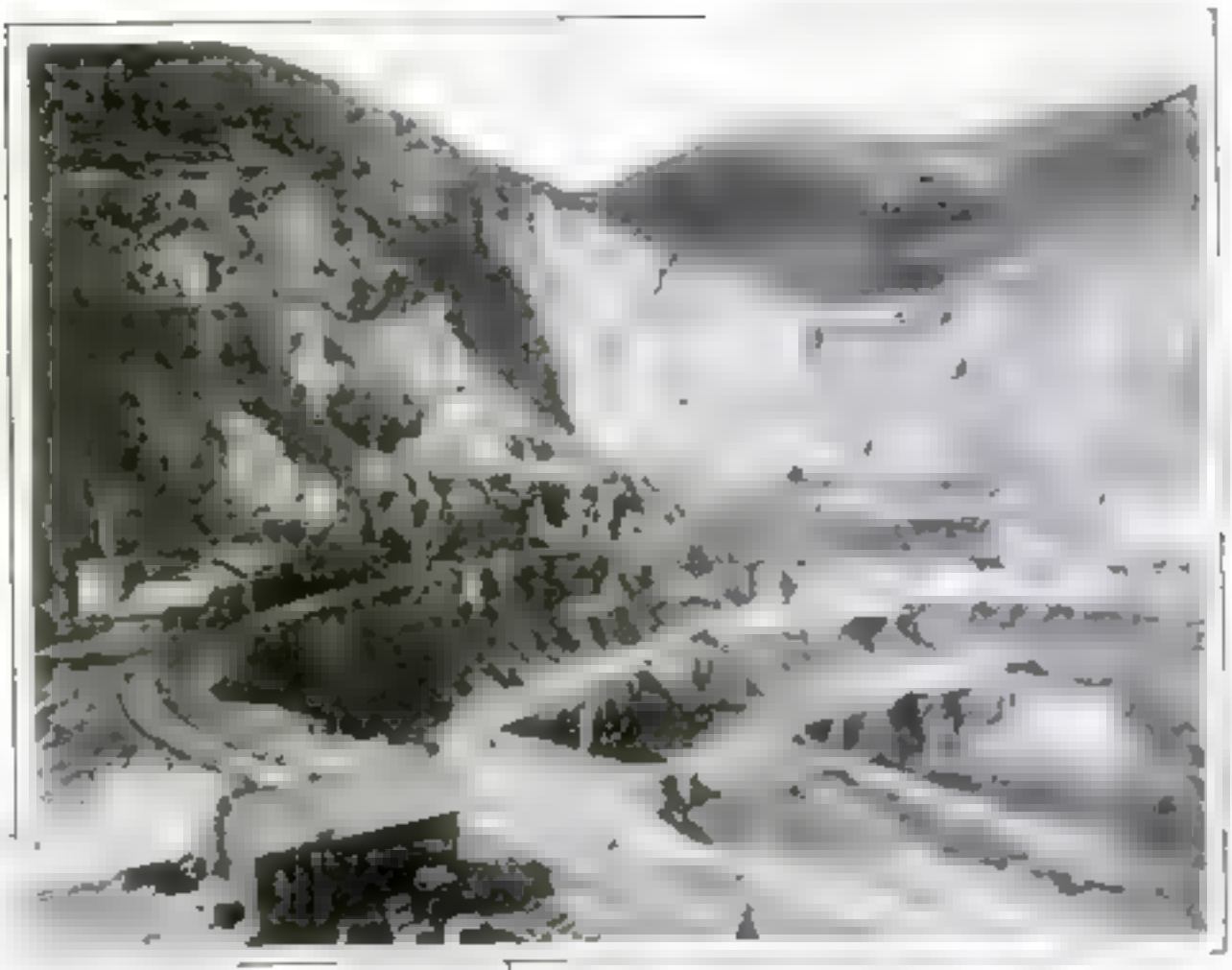
[illegible]



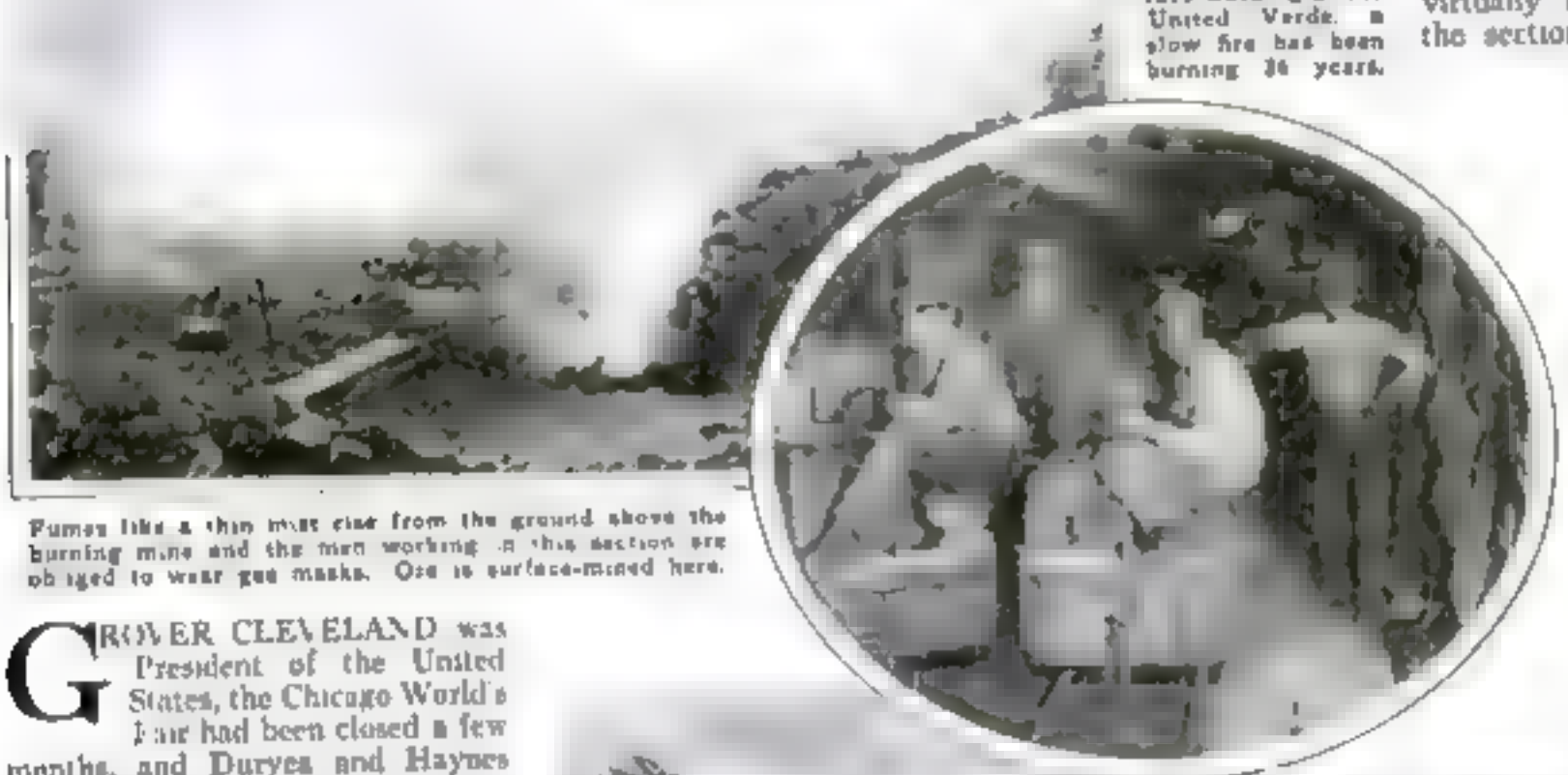
Although workmen [illegible] The [illegible] drawing shows how [illegible] sections of bags of [illegible] along the wreck. Inset shows how grave was dug and [illegible]

Work Mine in Spite of Old Fire

For thirty-six years copper ore in Arizona has been burning and efforts to extinguish it have all failed—Millions of tons are taken out each year



Beneath this surface working at the United Verde, a slow fire has been burning 36 years.



Fumes like a thin mist rise from the ground above the burning mine and the men working in this section are obliged to wear gas masks. One is surface-mined here.

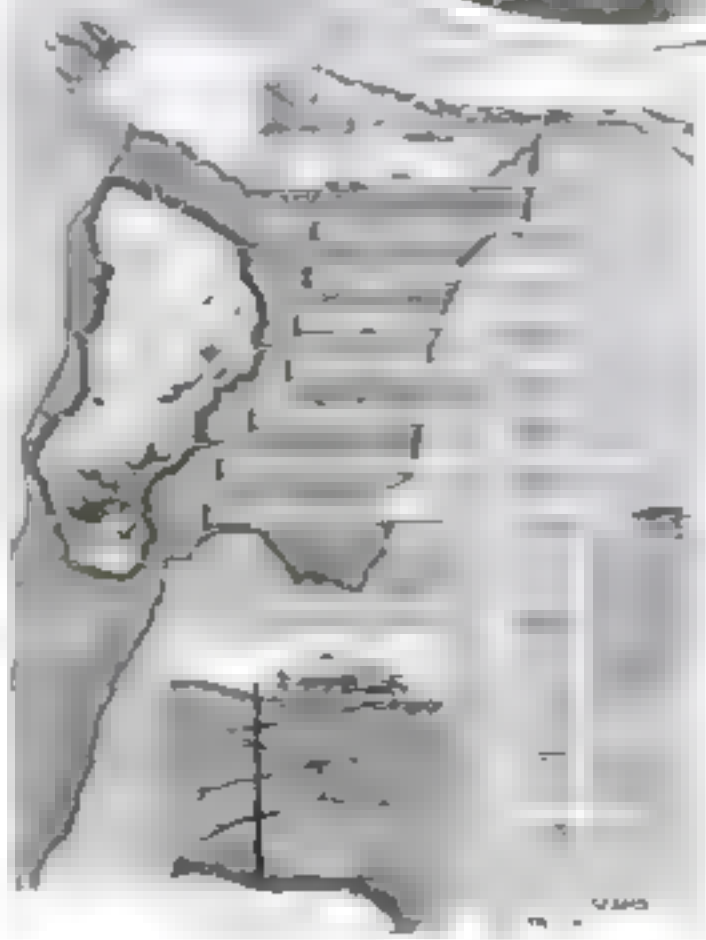
GROVER CLEVELAND was President of the United States, the Chicago World's Fair had been closed a few months, and Duryea and Haynes were demonstrating their first horseless carriages before skeptical multitudes, when fire broke out in the United Verde mine, on the eastern slope of the Black Hills in Yavapai County, Arizona.

That was thirty-six years ago. Today, the fire is burning still. But in the face of almost insurmountable difficulties—such as working around the blazing area, underground fires, surface gases, and dust explosions—engineers have succeeded in making the mine one of the world's largest producers of copper. This year a million tons of ore will be taken from the burning mine.

Just as you bank your fire before going to bed at night, the engineers have sealed off the burning part, which contains more than a million tons of ore, and now conduct mining operations above, beneath, and on the sides of it. At present, the United Verde is a highly organized, thoroughly ventilated working property, and virtually fireproof outside of the section filled with heated minerals and gases.

Imagine a twenty-story factory going full tilt despite the fact that four central rooms on the fifth floor are sealed up because an unextinguishable blaze that started more than a generation ago is raging within, and you have an idea of the man-size job done by the United Verde engineers and the conditions the miners work under.

The area containing ore is 800 by 1,200 feet and extends several thousand feet downward. Fire started at the 300-foot level in a section that contained 200,000 square feet of copper-bearing minerals. It was caused by the oxidation of the ores, whose sulphur content runs from ten to forty per cent.



Gathering the copper ore far below the burning section. At left, diagram shows how the mine is worked despite fire.

THE fire broke out in 1894. In those days, timber was used to support the tunnel roofs and serious cave-ins sometimes resulted from a collapse of these wooden structures. Caving produced enough friction to ignite the timber, whose flames in turn ignited the sulphur in the ore. The first fire occurred on the 300-foot level. Huge electric fans were installed that drew fresh air from the surface into the working area under sufficient pressure to force the gases, resulting from the fire, back into the ground.

The miners returned to work, but small fires occurred *(Continued on page 142)*

Here Are the Winners of the October Contest

FIRST PRIZE 500 DOLLARS
Walter W. Morgenweck, Newark, N. J.

SECOND PRIZE 100 DOLLARS
Frank M. Dugan, Utica, N. Y.

THIRD PRIZE 50 DOLLARS
A. L. Pruss, San Antonio, Tex.

TEN PRIZES OF TEN DOLLARS EACH

E. M. Fuson, Cleveland, Ohio
Andrew E. Goodwin, Bridgeport, Conn.
Charles D. Hold, Washington, D. C.
Andrew J. Kelley, Utica, N. Y.
Garth Kyler, Wagon Mound, N. M.
Sheldon Lahr, Bucyrus, Ohio
Harrison MacGregor, Fort Benning, Ga.
Bernhard Mathews, Jermyn, Pa.
Chas. A. Merritt, Racine, Wis.
W. Scott Mobley, Baltimore, Md.

FIFTY PRIZES OF FIVE DOLLARS EACH

Richard R. Almy, N. Providence, R. I.
George M. Beckett, New Haven, Conn.
Hollis Black, Jr., Cloverdale, Calif.
Evan G. Bower, Pasadena, Calif.
A. Boyd, Oakland, Calif.
H. A. Braendle, Flushing, N. Y.
Marion Burwell, Minneapolis, Minn.
Francis Campbell, Wallace, N. C.
Geo. R. Campbell, Albany, N. Y.
R. D. Carter, Hamilton, Ont.
E. L. Corwin, Columbus, Ohio
B. Dembner, Toronto, Can.
Allan Foster, Creighton, Nebr.
C. E. Garber, Pittsburgh, Pa.
G. B. Gilvogham, Gallipolis, Ohio
Samuel Gore, Fanwood, N. J.
H. R. Grasse, Green Bay, Wis.
Rene Gorschalki, Pasadena, Calif.
Harvey L. Gottlieb, Brooklyn, N. Y.
Homer W. Grove, Lincoln, Ill.
Ned Hackney, Ft. Wayne, Ind.
J. B. Higgins, Amarillo, Tex.
Madge Kabel, Winchester, Ind.
George P. Knorr, Chicago, Ill.
Matt Koenig, Chicago, Ill.
E. W. Lamb, Greenfield, Mass.
Eva M. Linscott, S. Lancaster, Mass.
Otis C. Marlon, Jackson, Tenn.
David W. Mathison, Tuckahoe, N. Y.
G. S. McDaniel, Atlanta, Ga.
Ernest Meier, Medford, Ore.
H. K. Ogawa, Los Angeles, Calif.
Erna Pole, E. Windsor Hill, Conn.
Herman Preiss, Lansing, Mich.
Earl S. Preston, Milwaukee, Wis.
George Henry Samson, Velva, N. D.
Charles T. Sharpe, Los Angeles, Calif.
O. H. Schussler, N. Warren, Pa.
George A. Seaman, Perth Amboy, N. J.
Stuart Shepherd, Margate City, N. J.
Vernon B. Shipley, Neoteska, Kan.
Seth S. Spencer, New York City, N. Y.
C. C. Spilman, Toledo, Ohio
H. Spooner, Newport, R. I.
J. M. Stofan, Garfield, N. J.
F. W. Trevarthen, Michigan Center, Mich.
Mildred Trowbridge, Chicago, Ill.
R. B. Trover, Michigan City, Ind.
Andrew Vena, New York City, N. Y.
C. W. Van Way, Jr., Columbus, Ga.

$1,000 in Cash Prizes

HERE is the last chance for you to get in on the big cash prize award! The "What's Wrong" Contest closes this month. That gives you just one more opportunity to win a first prize of $500, second prize of $100, third prize of $50, a $10 prize or one of the $5 prizes. Above on this page is the list of winners in the October contest. If you are lucky enough to find your name among them don't let that stop you from entering this one. Remember we told you that winning a prize in one contest would not keep you from entering another, or from winning a prize.

This month George Knowitall makes a final effort to prove that he is a handy man. We know that he isn't, but still George isn't convinced. Nothing but a majority vote will prove to our good-natured mistake-maker that he is a poor workman. In the last three numbers of POPULAR SCIENCE MONTHLY he showed that he was willing to tackle almost any job, but this is the last time he will display his ignorance for your benefit. See if you can show him up.

In each of the four pictures on the next two pages, George is doing one simple mechanical operation wrong, and the photographer, further to test your powers of observation, has made four other mistakes in each picture. Study the rules, see if you can find these errors, and send in your replies before it is too late.

In describing George's mistakes be careful to state exactly what you mean. Remember that the judges can only pass on the merits of your reply by what appears in your letter.

WHAT YOU MAY WIN IN THIS CONTEST

READ the rules carefully, on page 31, then find all the mistakes in the pictures. Send in your list and you may win one of the following cash prizes:

First Prize	$500
Second Prize	100
Third Prize	50
Ten Prizes	$10 each
Fifty Prizes	$5 each

Before Answering Study the Rules Carefully on Page 31.

Find Five Errors in Each Photo; 63 Big Cash Prizes

George Knowitall, in each picture on this page and on page 29, is doing a job and doing it wrong. Also in each picture there are four errors that were put there deliberately by trick photography. Find the five mistakes in each picture, send us your answer, and one of the sixty-three (63) cash prizes offered in this contest may be yours. All of the errors are easy to find—if you are diligent and know how to use your eyes. First, read the rules on page 31, follow their simple directions, and then sit down and study the pictures and try to win a prize.

Our old friend George Knowitall stops gaily in to help a friend on an amateur plumbing job. Above he is pulling with all of his might in an effort to take off a coupling. Is it likely that he'll succeed in the near future? Having found out what he's doing wrong look for four other errors that trick photography put in for you to find. They are easy to see—if you look closely

When it comes to doing a roofing job, old George is a wow! At the left you see him getting ready to lay an narrow shingle. Know-all insists he knows exactly how to make a narrow one out of a wide one. Would you do the job the same way? Remember there are four other errors to be found.

When his friend was about to call in somebody to fix a leaky downspout, helpful George happened to call and at once volunteered to fix the spout. At left you see him starting the repair job, using a soldering iron and solder from the radio workbench. He let the iron get thoroughly heated before he pulled the cord. How much would you bet that the spout goes right on leaking? Four other errors, slipped in by the camera, are there for you to discover

As a paint and varnish man George considers himself out about the last word. So when his neighbor's dining room table needs refinishing, he picks cleaning day to do the job. Now what mistake did George make and how will his friend feel later on? Having settled that, look for the four errors trick photography has put in the photo.

You Can Share in This $1,000

Last Month's "What's Wrong?" Contest Still Open to You

ON THIS page we are reproducing in small size the four photos that made up the third chapter in our "What's Wrong?" contest. Read the rules on page 31, find five errors in each picture, and send in your entry before December 31. The December issue, which can be examined free in public libraries or at any office of this magazine, shows the pictures in larger size.

Rules for What's Wrong? Contest

(Continued from page 27)

1. During each of the last four months beginning with October, and ending with this issue, POPULAR SCIENCE MONTHLY has printed four photographs depicting the adventures of George Knowitall. In each picture, Knowitall is doing some mechanical job in the wrong way. There are, in addition, four errors in each picture put there by trick photography. You are to tell us what Knowitall is doing wrong and what the photographic errors are—five errors in each picture.

2. Prizes will be awarded to those persons who point out these errors most accurately and clearly and in the most skilful manner. In ties the full prize will be awarded to each tying contestant.

3. Answers to each monthly contest must be mailed or delivered to the offices of POPULAR SCIENCE MONTHLY not later than the last day of the month following the date of publication of the magazine in which the pictures appear. Thus, to assure consideration in this month's contest answers to the pictures in this month's issue, published December 1, must be mailed or delivered not later than January 31. No entry bearing a postmarked date later than the closing date for entry will be considered.

4. Answers may be submitted on any kind of paper, but they must be typewritten or written in ink and on one side of the paper only. Each error must be listed separately and numbered. No changes or corrections will be allowed in any entry after submission, but any contestant may submit as many separate entries as he desires.

5. All entries should be addressed to the Picture Contest Editor, POPULAR SCIENCE MONTHLY, 381 Fourth Avenue, New York City. Name and address of the entrant must be written plainly on each page of the entry. Entries with insufficient postage will not be accepted. The publishers cannot be responsible for delay, loss, or nondelivery of entries. No contribution entered in this contest will be acknowledged and none will be returned. No letters of inquiry regarding points covered in the rules can be answered.

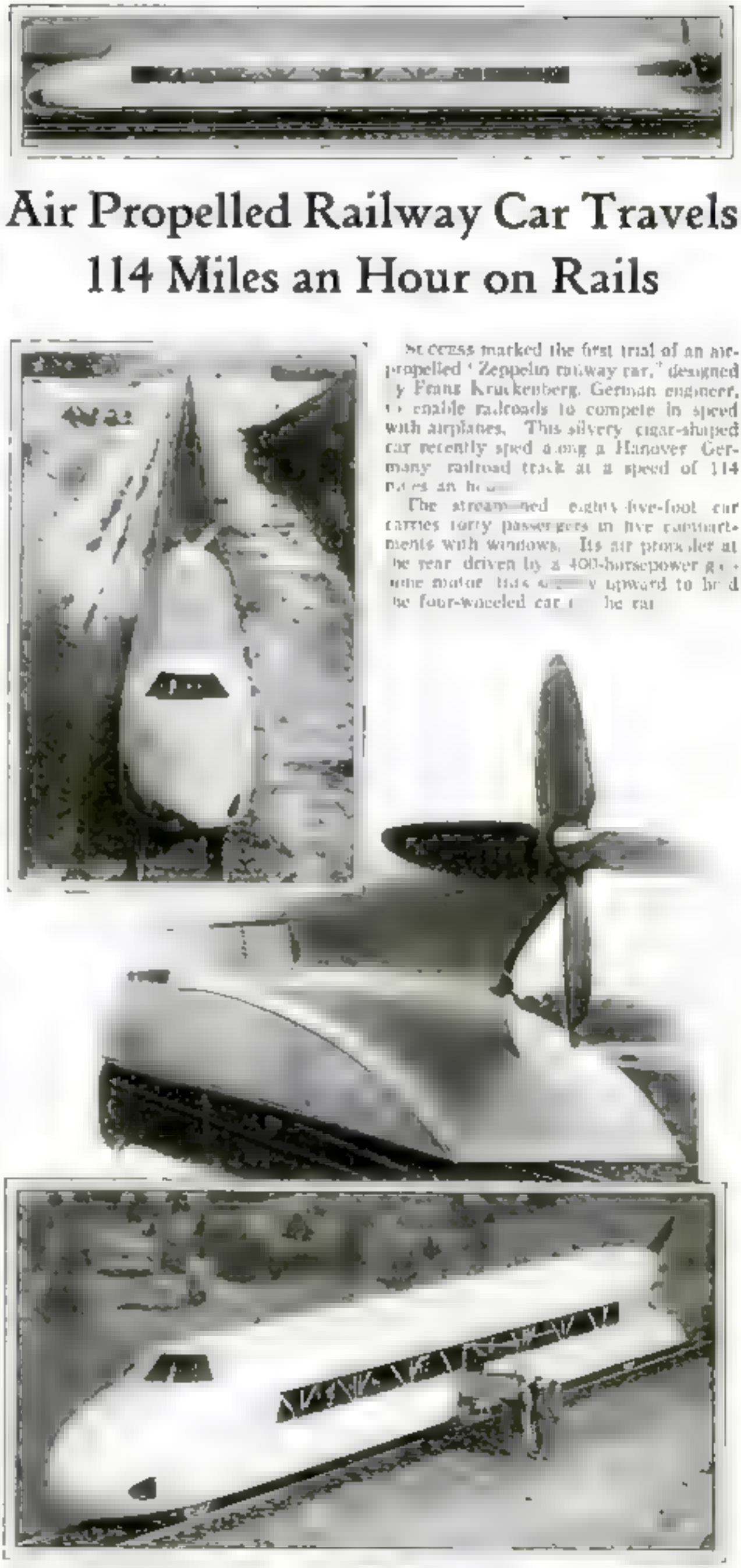
6. There is no entry fee. You need not buy POPULAR SCIENCE MONTHLY to compete. You can borrow a copy from a friend or you can examine one at any office of POPULAR SCIENCE MONTHLY or at the public libraries free of charge. Each contest is open to everybody except employees of POPULAR SCIENCE MONTHLY and the POPULAR SCIENCE INSTITUTE and their families.

The officials of the POPULAR SCIENCE INSTITUTE will act as judges and their decision will be final. The judges will work as expeditiously as possible in arriving at their decision, and the names of the winners, in addition to those appearing on page 27, will be announced in early issues of the magazine.

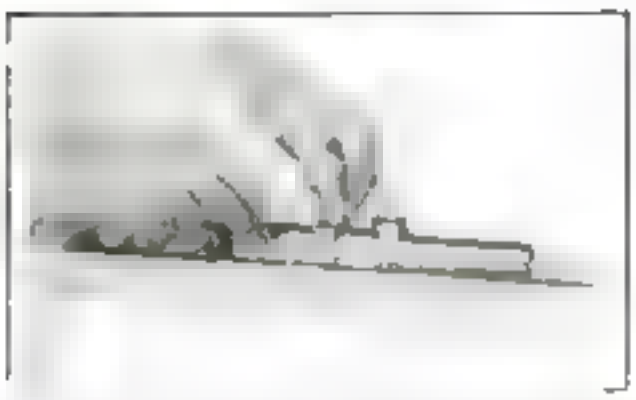
Air Propelled Railway Car Travels 114 Miles an Hour on Rails

Success marked the first trial of an air-propelled "Zeppelin railway car," designed by Franz Kruckenberg, German engineer, to enable railroads to compete in speed with airplanes. This silvery cigar-shaped car recently sped along a Hanover, Germany, railroad track at a speed of 114 miles an hour.

The streamlined eighty-five-foot car carries forty passengers in five compartments with windows. Its air propeller at the rear, driven by a 400-horsepower gasoline motor, lifts the car upward to bring the four-wheeled car [illegible] the rail.



This eighty-five-foot, German-built car for railroad service is driven by an airplane propeller. It carries forty passengers who enter through a center door. In tests it hit a speed of 114 mi. an hour



DIAL RULER SPACES OFF PARALLEL LINES

WHEN a draftsman needs to draw a number of neatly spaced, parallel lines, as in "cross-hatching" a section or marking in the symbols that represent certain kinds of structural metal, a new ruler is handy.

As the ruler advances across the paper on nonskid, grooved rollers, the dial at the right of the hand in the picture above registers the distance traveled in fractions of an inch. Thus a draftsman can space his lines at equal intervals. For very accurate settings, a thumbscrew moves the ruler as illustrated. The rollers are geared to the indicator and the thumbscrew drive

PONTOON CARRIES HOSE TO FIGHT WHARF FIRE

FIREMEN can play a stream of water on a wharf fire from below without going under the wharf with a new and recently developed This appliance, a steel buoy attached to the end of a long rod holds a hose nozzle in a vertical position.

For use it is placed in the water from a fire boat A hose is secured to it and the whole apparatus is pushed under the pier by the rod, hose being unreeled from the fire boat at the same time The stream of water is controlled by a valve on the boat instead of from the nozzle With this apparatus flames can be reached that were hitherto inaccessible or where approach to them was extremely hazardous.

The photograph at the right, above, shows the new fire fighting weapon being demonstrated on a Boston pier

A steel pontoon, with a guide arm, carries the fire hose beneath wharf to fight dangerous blaze

GOLF BUNKERS ON MAP MADE BY GOVERNMENT

THE United States Geological Survey has prepared a series of maps of the Chicago district which are so complete that even golf bunkers are shown. A series of twenty of the unusual maps, which are believed to be the ultimate in cartography and intended purely for reference, have been prepared. However, golfers in doubt are privileged to consult them.

DOUBLE-SEATED CHAIR PRESSES TROUSERS

A GERMAN has perfected a chair that presses trousers. It is designed with two "seats," the upper one hinging back against the back rest. When being used as a pressing machine, the trousers are laid across the lower seat, and the upper one is closed down over them. Two clamps hold those portions of the trousers which extend beyond the seats. The chair is then sat upon, preferably by a heavy person, until the garment is pressed.

A hinged upper seat allows this chair to press trousers. Two side clamps hold them straight.

POWERED BUOY AIDS LIFE GUARDS

Above, J. E. Haschke, of Long Beach, Calif., demonstrates his recently developed powered buoy which is meant to drag a life guard swiftly to drowning bather.

A RESCUE device for life guards, recently invented by J. E. Haschke, of Long Beach, Calif., resembles a toy motorboat in appearance. It is a boat-shaped buoy driven by an electric motor and tows a life-saver to a drowning person more quickly than one could swim.

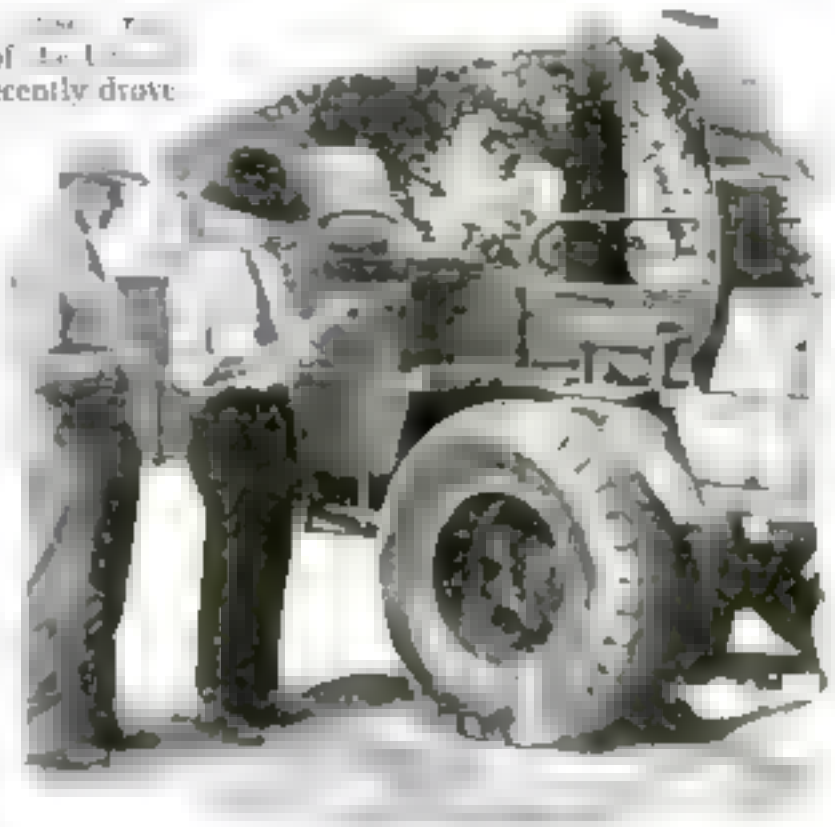
It is placed in the water and the user stretches out behind it, steering by means of a handlebar and controlling the motor by buttons. Power is furnished by a storage battery. The propeller is placed under the boat, as shown in the large illustration above where it will not interfere with the user

The life-saving buoy pulling a life guard through the water

TEST BIG BUSES' WEAR OF ROADS

WILL modern high-speed [illegible] public highways? Engineers of the United States Bureau of Highways recently drove a specially-equipped bus chassis at varying speeds up to fifty miles an hour over good and bad roads at the Bureau's experimental station in Arlington Virginia, in order to find an answer to this question. The test chassis was fitted with electrical devices that registered shocks and jars

Actual operating conditions were approached as nearly as possible and the chassis, with weights equaling those of body and passengers, made a load of seven thousand pounds. An observer is shown in the picture studying the electrical measuring apparatus over the car's wheel



FIRE BALL HEATS BOILER

BALANCED on a vertical jet of air, a huge ball of flame supplied heat for a 500-horsepower boiler in recent tests to find the best method of using powdered coal fuel and air were shot upward into the center of the fire box, where the light particles burned in mid-air Ashes and cinders fell back onto a specially prepared grating at the bottom of the fire box.

Wood refuse has also been burned by this means of combustion, which is expected to show greater economy than the old flat-grate style of firing

HINGED CLIP ON COLLAR BUTTON HOLDS FAST

THE elusive collar button, which falls out of shirts and rolls under furniture and into inaccessible corners, has been trapped by a device recently perfected in London It consists of a button having a hinged clip that lifts up against the vertical part of the stud so it can be inserted in a shirt When it is in place the hinged fastener is sprung down, locking the stud with a strong grip on the edge of the buttonhole. Another advantage of the device is that it also serves to keep the tie in place

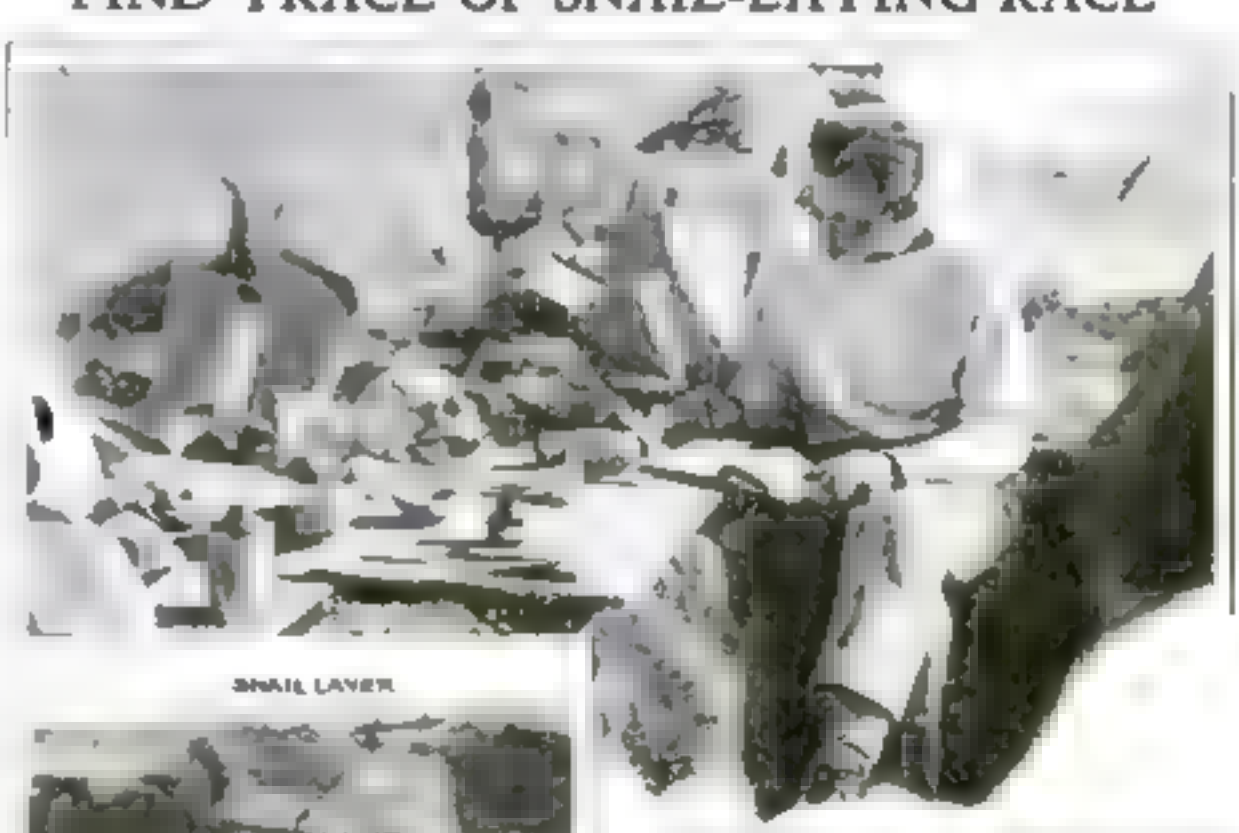
INSIDE FROSTED BULBS NOW BIG OR LITTLE

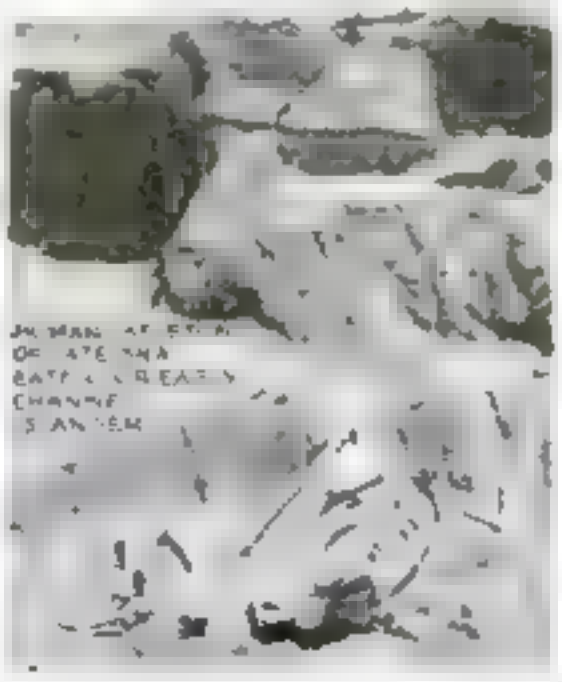
INSIDE-frosted electric light bulbs, designed to eliminate shadows of hangers and fixtures on walls and ceilings, are now available in sizes up to 500 watts. Formerly they were on the market only in smaller sizes. The inside frosting of bulbs was discovered by accident and is accomplished by etching the inside of the bulb with acid.

For illumination of modernistic interiors and where lighting comfort is the first requirement inside-frosted bulbs give a soft glow, and lend themselves to many lighting effects [illegible] with older styles of bulbs

Inside-frosted light bulbs are now made in many sizes, ranging up to 500 watts.

FIND TRACE OF SNAIL-EATING RACE

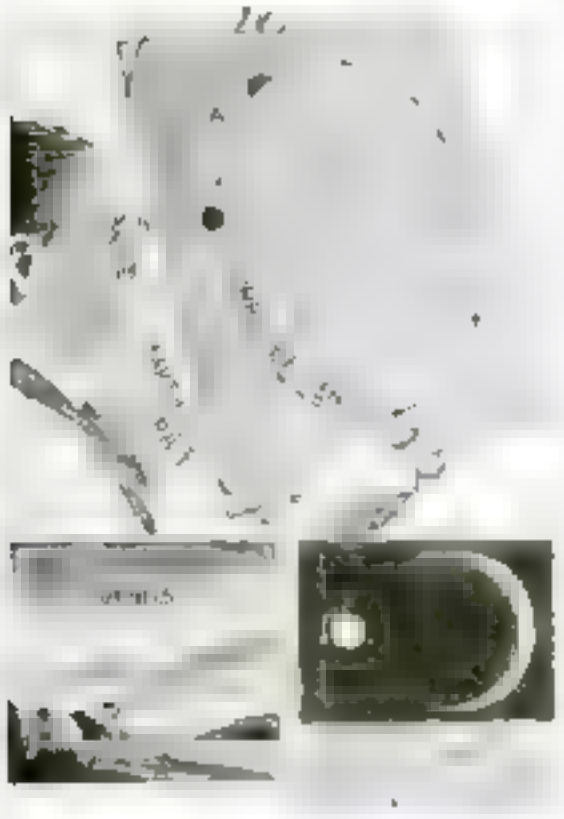




Relics of snail eaters, at top, and above, diagram of rock strata and position of remains.

EXCAVATING on the wind-swept fog-shrouded slopes of San Nicholas Island, one of the Channel Islands sixty miles off Ventura, Calif., scientists of the San Diego Museum recently discovered traces of a vanished race of snail-eating people Where they came from and what became of them could not be learned, but some bones and stone tools gave a clue as to their manner of living.

When the archeologists dug away the surface soil of the island they discovered remains of camps and hearths on the rocks beneath, suggesting that human beings lived on the bare rocks before land was formed on them. The chief food of this strange people consisted of snails. Specimens were brought back to San Diego for study in an effort to solve the mystery



VENUS BRIGHTER WHEN WE SEE LESS OF IT

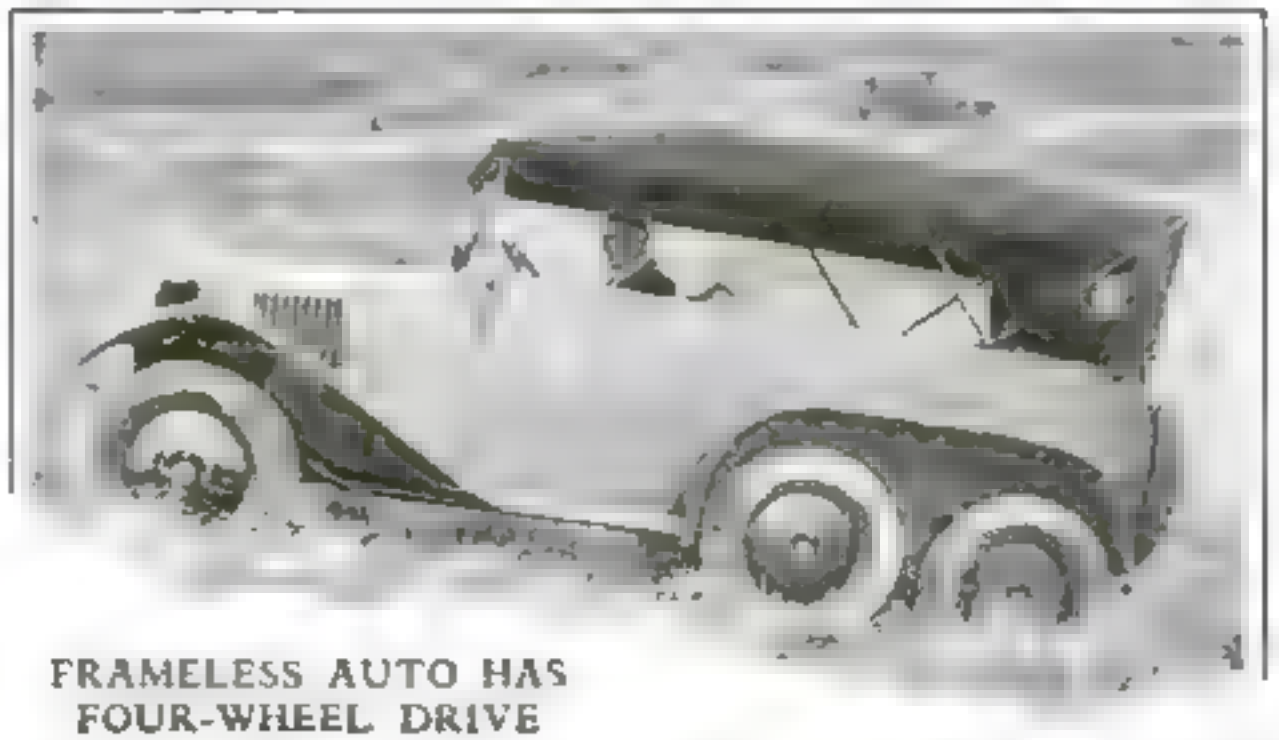
ALMOST everyone knows that the bright star we often see in the West near the new moon is Venus but few know that this planet goes through all the phases from "new" to "full," just as the moon does. Still fewer know that, unlike the moon Venus is many times brighter when she is a thin crescent than when we see her full face'

The diagrams above explain both this surprising contradiction and the reason for the planet's phases

The circle drawn on the piece of cardboard held by the man represents the orbit of Venus, with the sun at its center. A larger imaginary circle passing through the man's eye, is the earth's orbit. It is plain that Venus can never appear farther away from the setting sun than the angle *A B C* (about forty-five degrees) and that twice in its orbit, it is in line with the sun and earth—once on the far side of the sun, and once on the near side between the sun and us.

The "crescent," "first quarter," and "full" symbols along the orbit show how Venus appears to us, at these points in her path. The phases are visible in a small pocket telescope or powerful field glass magnifying ten or more diameters. Galileo discovered them with his telescope, which was about this power.

Now for the contradiction. Another glance at the sketch explains it. When Venus is "full," she is about 134,400,000 miles more distant than when showing us her "crescent." The two small images, showing her comparative sizes at maximum and minimum distance, prove that, even as a thin crescent, Venus reflects more of the sun's light to us than when the compete area of her disk is visible.



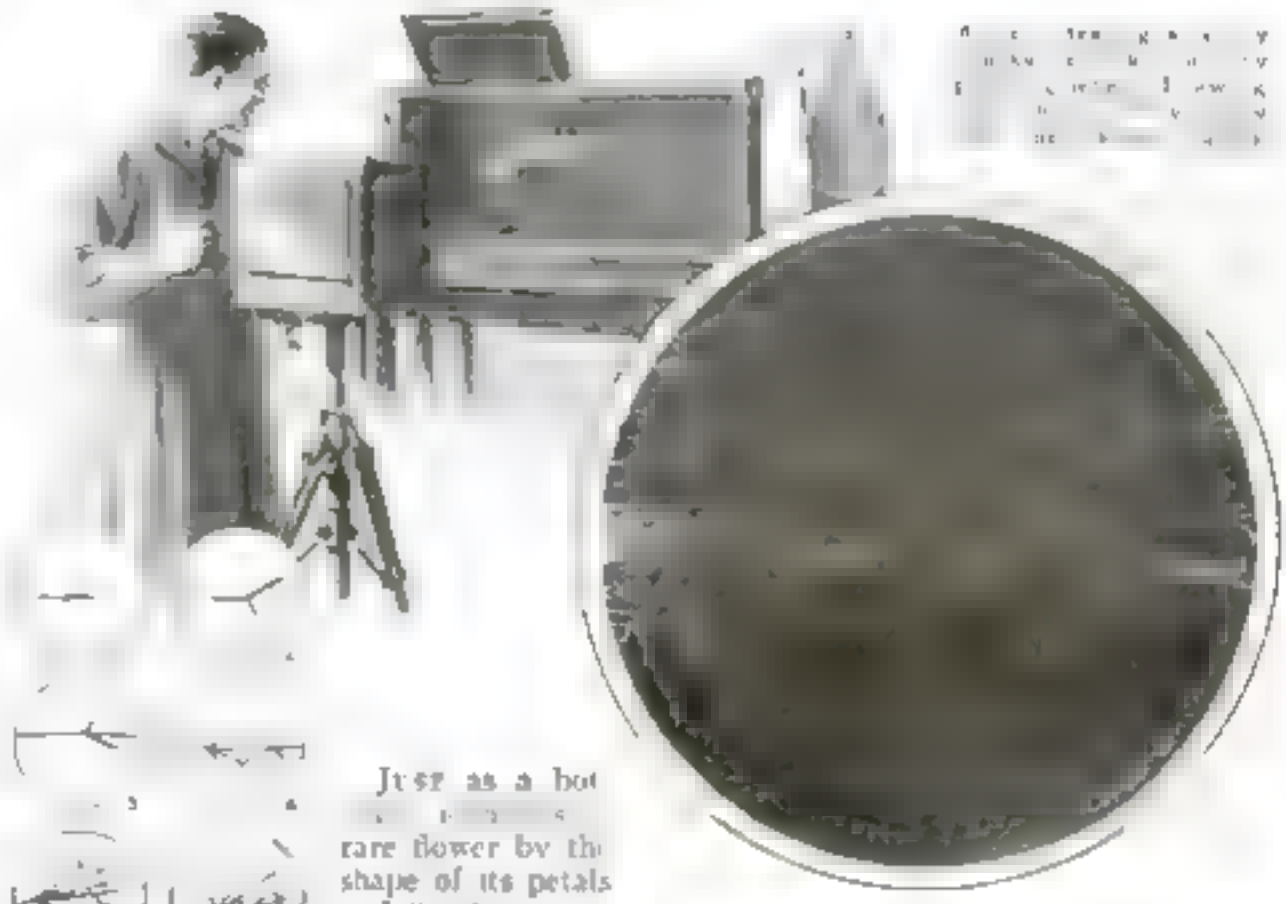
FRAMELESS AUTO HAS FOUR-WHEEL DRIVE

FRAMELESS, six-wheeled, four-wheel-drive automobiles may soon be seen on the roads of the United States, for such a car, the first ever brought to this country, is now undergoing tests in Detroit. These cars were developed by a Czecho-Slovakian motor car firm during the World War for the use of German army officers in crossing shell-torn ground at high speeds.

In order to obtain flexibility under all sorts of operating conditions, the cars have been equipped with eight forward speeds and four reverse speeds instead of the usual three forward and one reverse used on most American cars.

The four driving wheels are so arranged that they are always in contact with the ground, no matter what its contours may be. It is propelled by a four-cylinder twelve-horsepower horizontal motor. Pairs of cylinders, on either side of the crank shaft, make it an "opposed" motor

STEEL CLASSIFIED BY ITS SPARKS



Just as a bot[illegible] rare flower by the shape of its petals and its stem, so a French aeronautical engineer, E. Pitois, classifies the nature of a piece of steel. He can tell how well it has been hardened by watching the shape of the flowerlike sparks that fly from it when held against a grinding wheel that is being whirled rapidly

He discovered recently that every type of steel gives a characteristic form of spark, different from any other type. This short cut may save factories untold time in making complicated analyses. It is easy to put a sample in the test apparatus which Pitois has devised and to observe or photograph the incandescent fragments that fly off

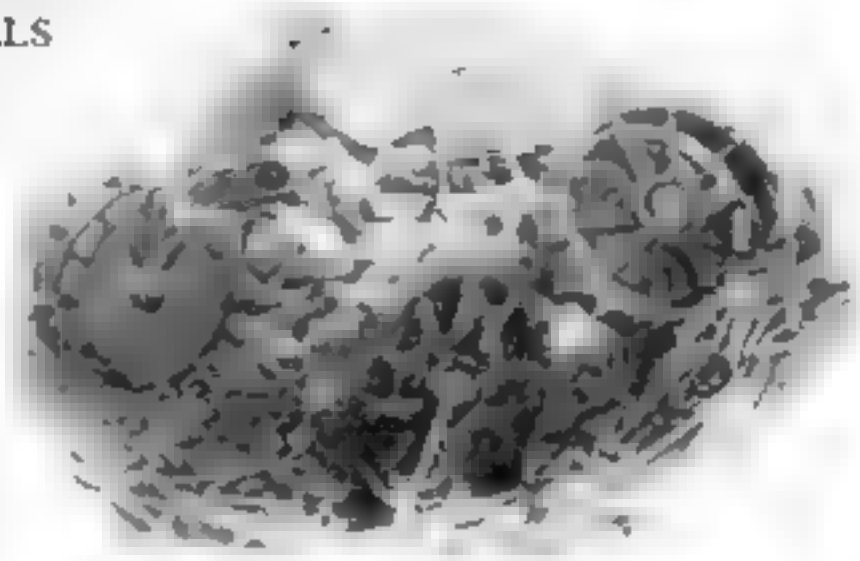
Such sparks as fall from the burning metal filings in a Fourth of July sparkler tell a complete story of the metal. Lancelike sparks, with no sideward streamers, like No. 1 in the small sketches, are typical of extremely soft steel. The other sketches, numbered in order of the increasing hardness of the steel, show more elaborate forms with side branches. The hardest steel gives patterns that might be mistaken for living plants, as shown in No. 6 and in the large photograph above.

These tests were made in air. Pitois obtained red-glowing fragments when he filled the windowed chamber with carbon dioxide gas, and brilliant fireworks when oxygen gas was used.

ACROBATIC TRACTOR WORKS STEEP HILLS

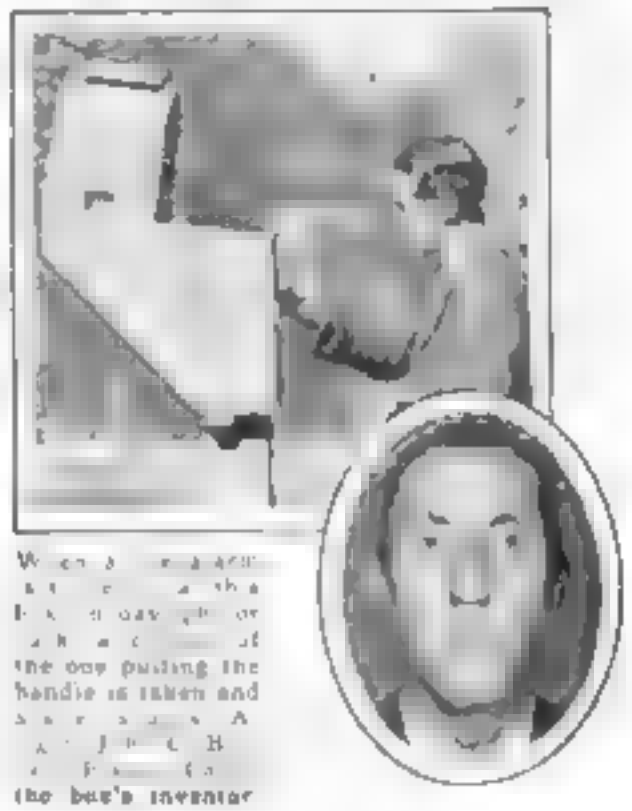
A CONTORTIONIST among tractors is a new vehicle that works on any slope or angle of ground that can be traveled by a horse. The machine can do the work of a four- or six-horse team, either with farm implements for horses or with equipment designed for tractor use only.

The machine is especially adaptable for working with a cultivator, as it has an axle clearance of thirty inches and can span two furrows. If necessary the operator can ride on the cultivator and control the machine from it. The tractor has three-point suspension and when standing still most of the weight is in front, but this is transferred to the rear when in operation, so weight is evenly distributed.



New farm tractor that can climb hills or work steep slopes, dragging a load anywhere it is possible for horses to travel.

FIRE ALARM BOX TAKES PICTURE, SOUNDS SIREN

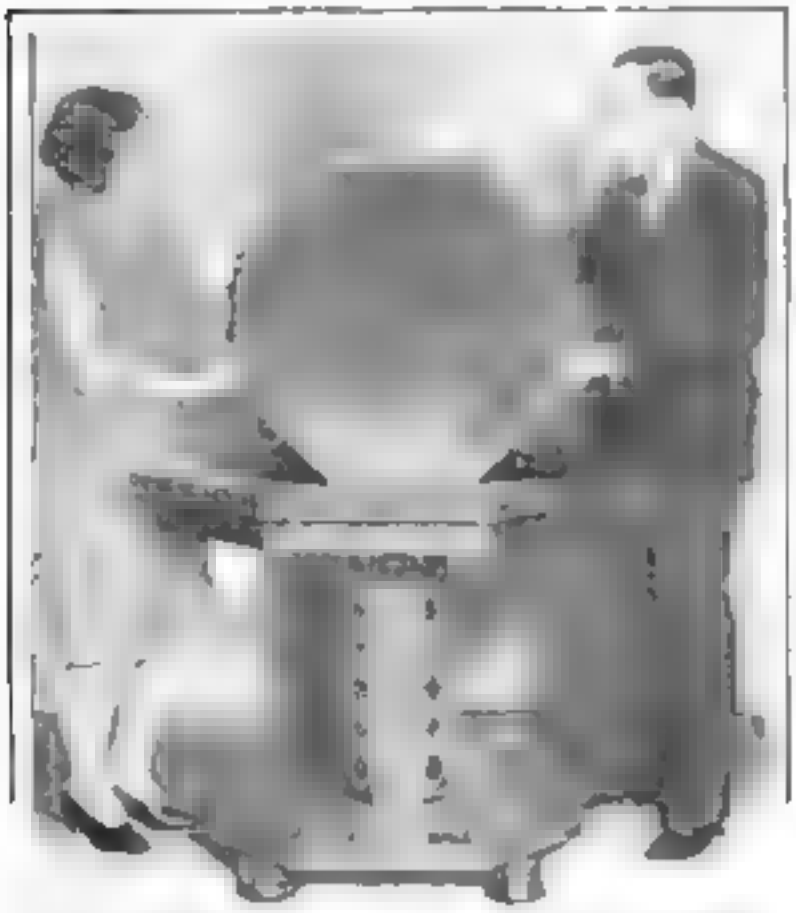


When [illegible] the one pulling the handle is taken and [illegible] the box's inventor.

SECURING an automatic picture record of persons turning in fire alarms is the object of a new style fire box recently invented by John C. Burnett, of Fresno, Calif. When the lever is pulled a flashlight charge explodes and a camera in the box takes a picture of the one sounding the alarm, either in the daytime or at night. With the subject twenty-four inches from the camera, the vertical photographic range is twenty-two inches and the horizontal range forty-eight inches. A bell or siren is connected to this apparatus and sounds for a certain length of time after an alarm has been rung in.

This device, it is believed, will greatly reduce the number of false alarms, because the sender of such a signal does not care to have his picture taken in the act of doing it or risk detection as a result of the loud signal from the box. A somewhat similar device was tested some time ago in New York City (P. S. M., Oct. '30, p. 71) which took daylight movies of the alarm sender, but the new device pictured above works equally well day or night.

WOOD FROM 17 NATIONS IN TABLE



After seven years of work, a disabled World War veteran has finished this unique table of wood from 17 countries.

CONSTRUCTED of wood from seventeen different countries this "international" table was made by George L. Hathaway, disabled World War veteran at the Maybury Sanitarium Michigan. Seven years of labor were required to finish it. The Michigan branch of the American Legion sent the builder to the Legion convention at Boston to exhibit this example of his painstaking work.

HENS MUST NOW LAY BIG EGGS

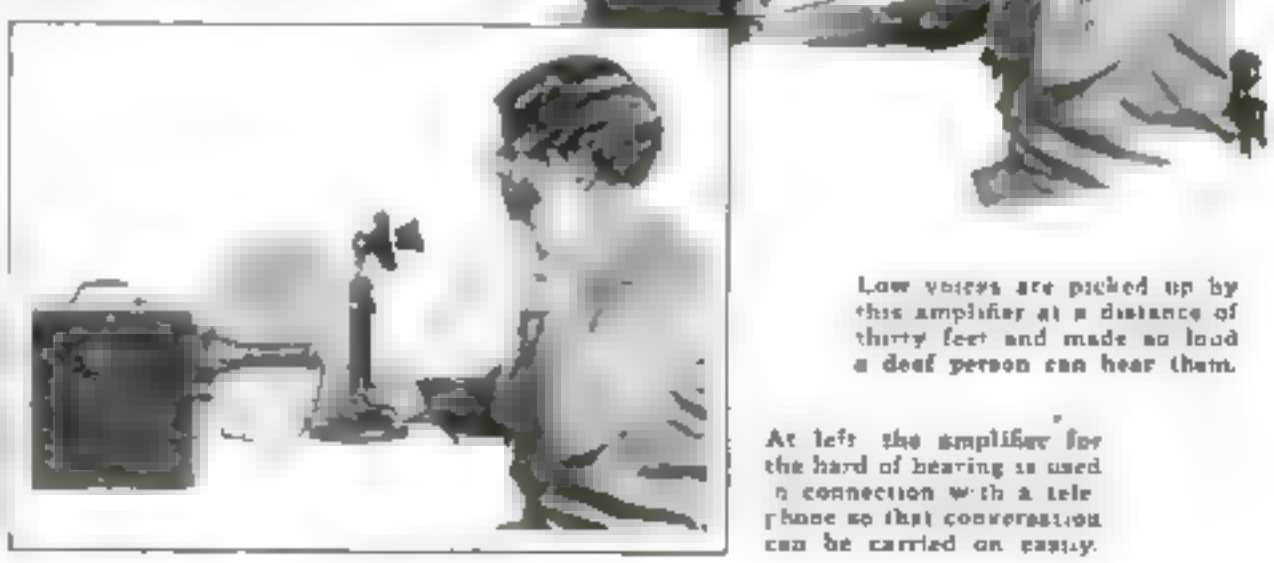
BARNYARD hens may soon find that they must lay eggs up to a certain standard of weight, as an electric egg recorder keeps track of their performances. It can be set so that if an underweight egg is laid, a device will automatically trap the hen in her nest. She will then be removed, painlessly put to death, and used for food.

AMPLIFYING SET MAKES DEAF HEAR

PEOPLE who are inclined toward deafness have no difficulty in hearing telephone conversations if they use a high-power amplifying set recently developed. The new instrument can be used in connection with a telephone, without being attached to it, or it may be employed in listening to ordinary conversations.

The apparatus, when being used for telephone conversations, will pick up voice sounds that cannot be heard by the average ear and make them audible to the listener. When it is used without a telephone, low voices thirty feet from the set are amplified so people who are hard of hearing can hear them clearly. The apparatus weighs but ten pounds.

The amplifying in this device is accomplished by means of combination condenser and air resistance in place of the carbon transmitters now in use. An adjustable knob in front controls the volume. In telephone conversation, the phone receiver grips to the set and the user listens through an earphone.



Low voices are picked up by this amplifier at a distance of thirty feet and made so loud a deaf person can hear them.

At left the amplifier for the hard of hearing is used in connection with a telephone so that conversation can be carried on easily.

Aircraft Carriers Give American Navy Long Arm

FROM the decks of the U. S. S. *Saratoga*, *Lexington*, and *Langley* fly bombing planes which, with their potentially destructive loads, will travel 175 miles, drop their heavy explosives, and then return to their floating home.

A fourth carrier, as yet unnamed, will join the fleet in the spring of 1934. In naval terminology, she is called the *CV-4*—aircraft carrier number four—and will be the first ship in the American Navy designed from keel to flight deck as an aircraft carrier. The *CV-4* will add power to the long-reaching punch of the fleet as it will have on board some seventy-five planes, many of them bombers.

A formation of twelve bombing planes represents a force with which modern-day fleet commanders must reckon, both offensively and defensively, for they carry 12,000 pounds of explosives with a thirty percent chance of hitting the enemy at a range of 175 miles.

The vulnerability of carriers is their weak point. For this reason, the Navy has pointed out that to crowd all of the fleet's long-reaching punch into three carriers is inadvisable. In 1927, the Navy Department asked for five additional ships of this type, designed especially to carry airplanes. Following the request, the *CV-4* was authorized in 1929 by Congress, and the contract for the ship was awarded a few weeks ago.

A comparison of the *CV-4's* design with that of the present carriers reveals some remarkable differences. It should be borne in mind, however, that the *Langley* is the ex-*Jupiter*, a collier converted by the Navy for an experimental carrier, and that the *Saratoga* and her sister ship, the *Lexington*, were designed originally as battle cruisers and that they were converted by the Navy to aircraft carriers in accordance with provisions of the Washington naval limitation treaty of 1925.

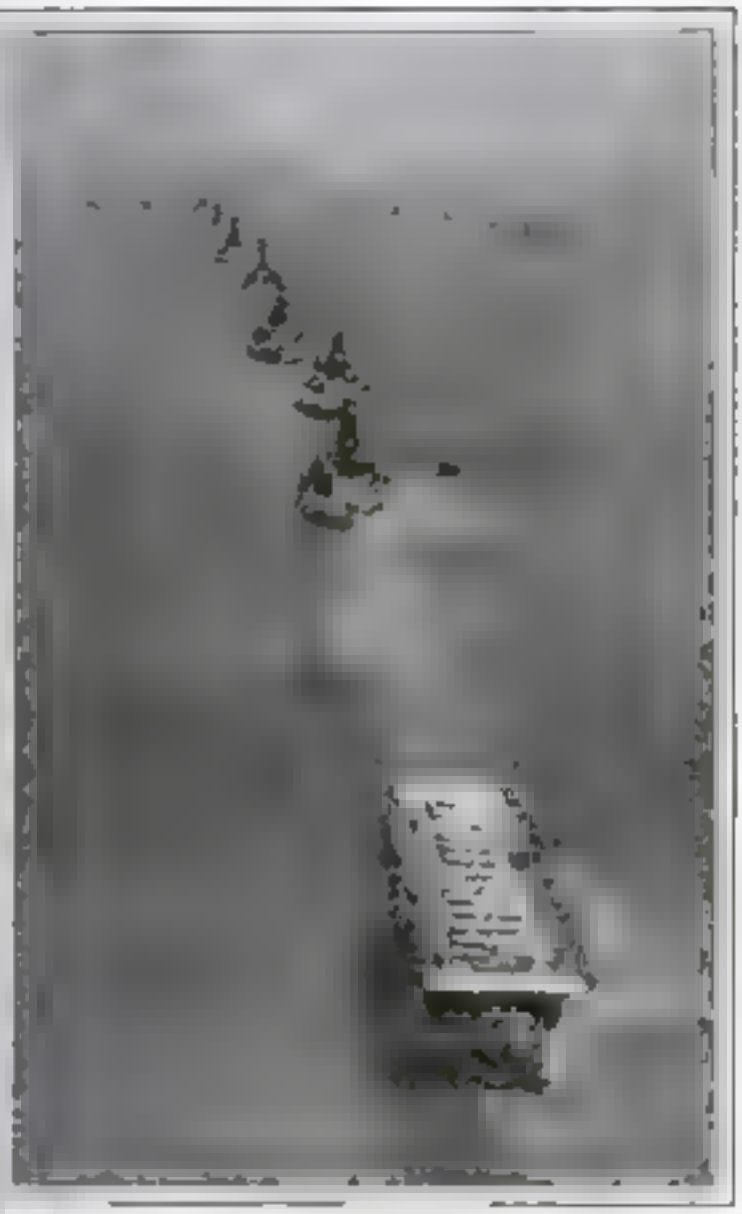
THE *CV-4* will displace only 13,800 tons, but will accommodate seventy-five planes, almost as many as either the *Saratoga* or the *Lexington*, each of which displaces 33,000 tons. The *CV-4* will be of a flush-deck type with no central

Since the *Langley* is an experimental carrier and may be replaced at any time, the carrier tonnage of the United States is represented by the *Saratoga* and the *Lexington* of 33,000 tons each and the prospective *CV-4* of 13,800 tons, or a total of 79,800 tons. Hence under the recent London treaty, 55,200 tons of aircraft carriers are still permitted the United States Navy.

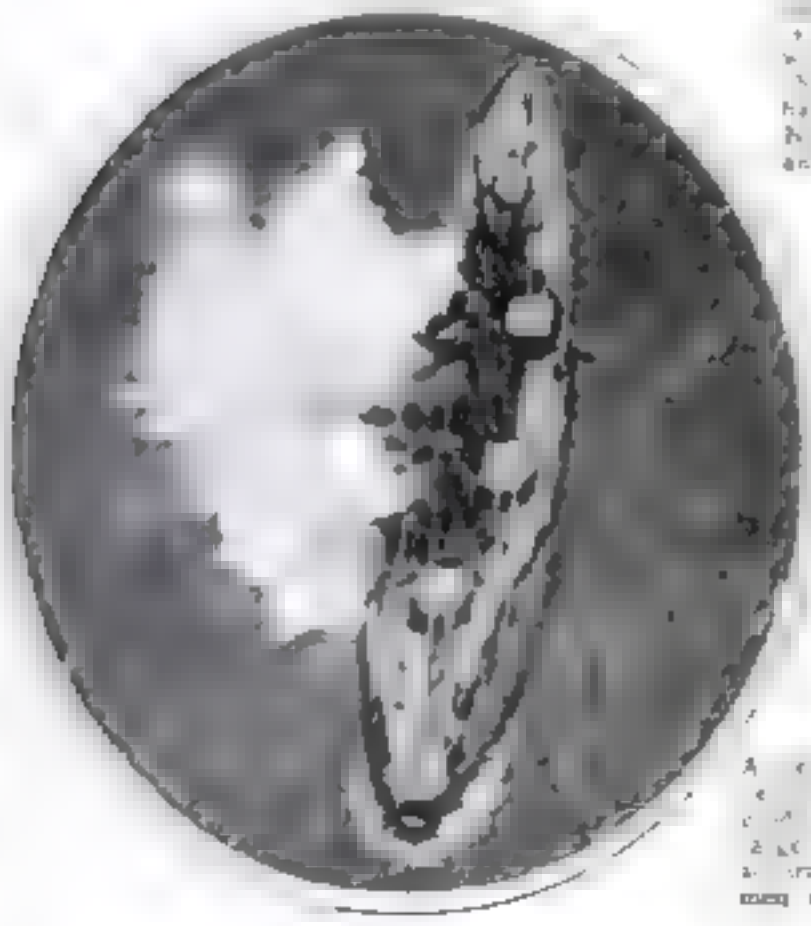
The possibility of combining the gun strength of a cruiser with the flight facilities of an aircraft carrier was debated during the course of the Congressional hearings on the London naval treaty. Such ships would increase the number of planes to be carried by the fleet and at the same time allow the ships transporting them a certain amount of offensive gun strength.

Under the treaty provisions, it is permissible for the United States to build 180,000 tons of eight-inch-gun cruisers and 143,500 tons of six-inch-gun cruisers. The eight-inch cruiser complement at present is being filled with new construction in progress or authorized. The six-inch complement, however, totals but 70,500 tons built, leaving 73,000 tons neither authorized nor appropriated for.

Fighting gradually worked from the sky to the Lexington deck, the crew of the gas-filled vessel was rescued. A rescue [illegible] through [illegible]. Seventy-five such [illegible] carry 2,000 [illegible]

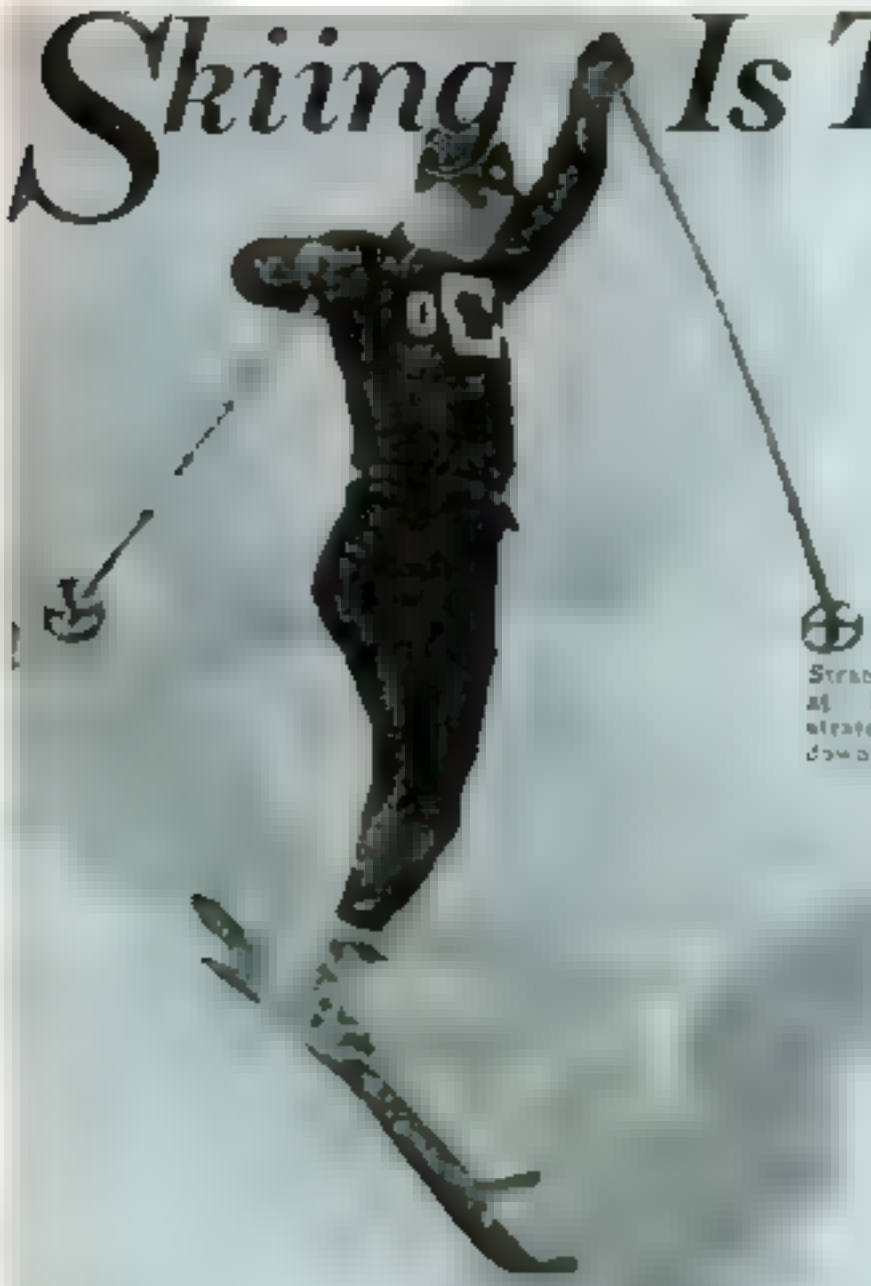


[illegible] the Lexington [illegible] with the fighting [illegible] Japs, one of which has [illegible] Five figures [illegible] another plane ready



A [illegible] escaping [illegible] showing how [illegible] men of air become.

Skiing Is Thrilling Sport Easy to Learn



Strand Mikkelsen, at left, demonstrates one of the ways of getting down a long hill

WORLD Famous Expert on Skis Tells You Here How to Use These Seven-League Shoes for Level Travel or Breath-Taking Leaps

IF all the people in New York, Boston, Philadelphia, Cleveland, Detroit, Chicago, St. Louis, and San Francisco went skiing at once their number would be no greater than the huge army of enthusiasts who actually indulge in the sport. Throughout the world more than 10,000,000 persons last winter strapped on skis and ran, slid, and leaped from hills on these seven-league wooden shoes.

Each season the sport gains new converts. Although it is only twenty-five years old in this country, there now are 200,000 skiers in the United

[illegible] I know of no thing more [illegible] and exhilarating, and I have tried and enjoyed several other sports, including skating [illegible]. Among winter sports, skating is king, but for pleasure, it compares with snowshoeing as apple pie does with bread-and-butter. It beats skat-

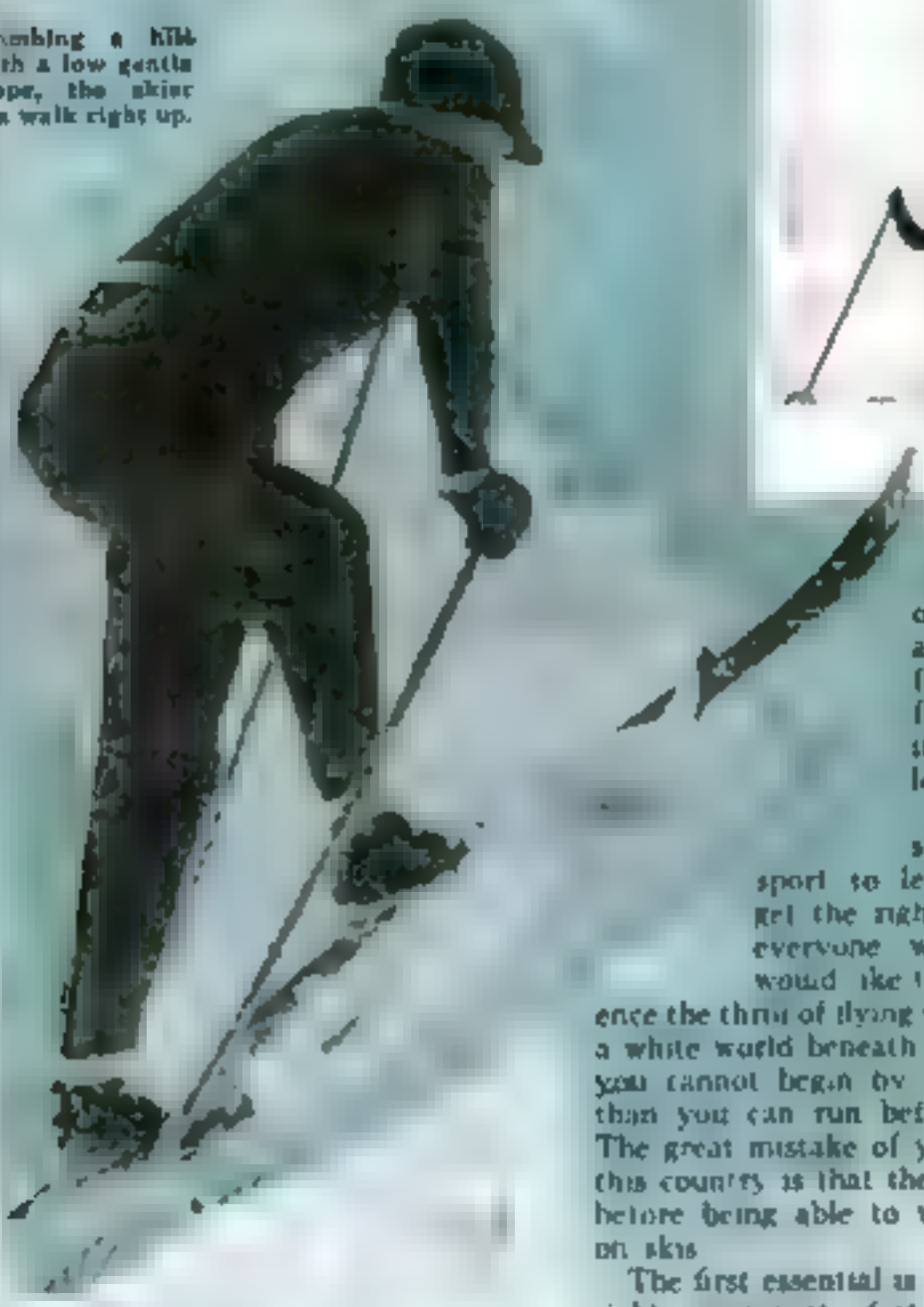
There are only two types of ski jumping that are recognized as such. One of them is the [illegible] seen above, in which the skier bends his body at the hips

In the Christiania swing the [illegible] is forward

In [illegible] the Christiania swing, the [illegible] ski is kept constantly advanced and steered with weight on that foot. Arms maintain balance.

As Told to John E. Lodge

By STRAND MIKKELSEN



Climbing a hill with a low gentle slope, the skier can walk right up.

The skiers at left and right are executing the Telemark swing, while the man in center of the picture is doing the side jump

ing because it is far less restricted as to place and time. In skiing the whole snow-covered world is your playground, and in the right kind of country you can enjoy months of the sport each season.

The best thing about skiing is that it is easy to learn and, once mastered, offers infinite variety. There is no chance of its getting monotonous. I have been skiing for eighteen years—since I was a boy of eight in fact—and I never yet saw two ski hills that were alike, nor one that was the same on different days. Every new landscape, every new snow tests the powers of the skier in another way. The fun is always as fresh as the snow itself and lasts as long.

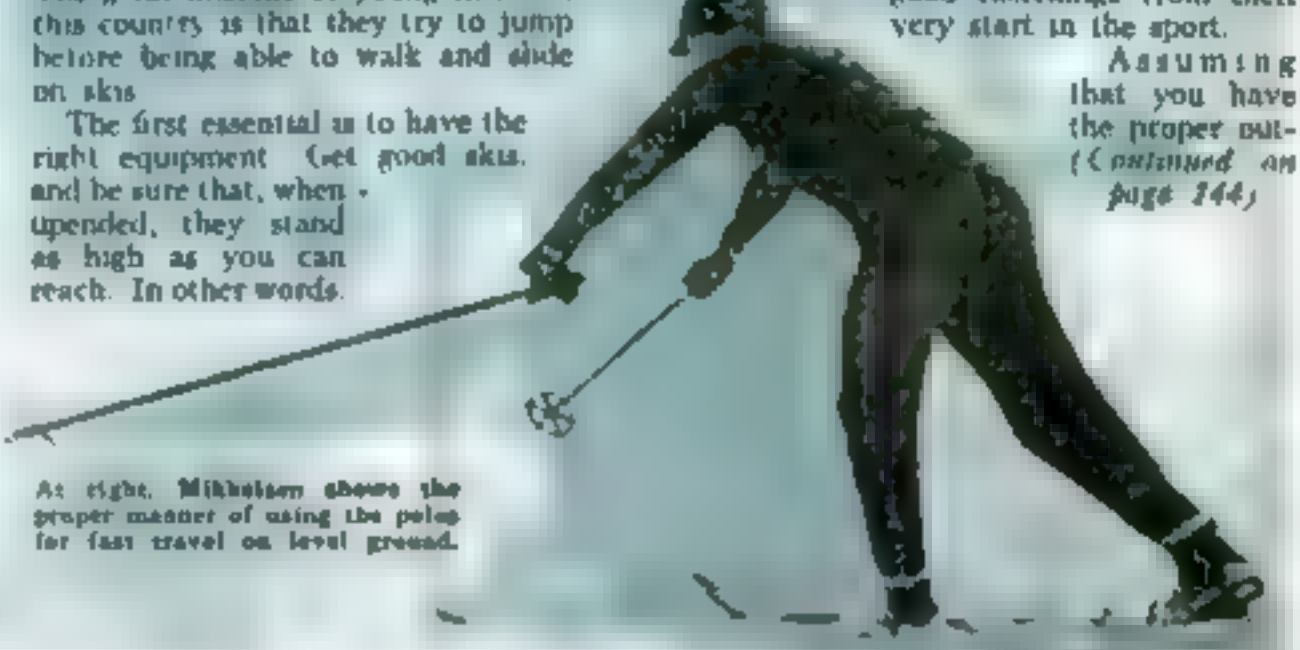
As far as I know skiing is the simplest sport to learn—provided you get the right start. Naturally, everyone who wants to ski would like to jump and experience the thrill of flying through the air with a white world beneath him. But in skiing you cannot begin by jumping any more than you can run before you walk. The great mistake of young skiers in this country is that they try to jump before being able to walk and glide on skis.

The first essential is to have the right equipment. Get good skis, and be sure that, when upended, they stand as high as you can reach. In other words, if you, for example, are five feet ten inches tall and can reach one foot above your head, your skis should be six feet ten inches long. Then buy a pair of good ski boots.

The most important item, however, is the fastenings, which should be strong and heavy and correctly fit the boots. Remember this, for not having proper bindings will set you back in skiing, and you never can learn to jump with poor bindings. One of the main reasons for the prowess of Norwegian, Swedish, and Swiss ski runners is that, no matter how young they were when they began their ski-ing, parents provided them with good fastenings from their very start in the sport.

Assuming that you have the proper out-

(Continued on page 144)



At right, Mikkelsen shows the proper manner of using the poles for fast travel on level ground.

The herringbone step. This is used on steep, short, and narrow trails.

Mikkelsen shows how to start the kick-turn.

Second movement in the kick-turn. Here the ski is being brought horizontal,

Completing the kick-turn by bringing right foot to left.

Flying *with the* Pioneers

Thrilling Events in the Air Are Told in This Second Part of the Unusual Story of

"My Forty Years of Flying"

From left to right these are y figures in the dramatic story of Aviation are Thomas Scott Baldwin, Harriet Quimby, Bud Mars, Lincoln Beachey, Orv l e Wright, Wilbur Wright, Eugene Ely, Earle T Ovington, Oscar Brindley, Tom Sopwith, Walter Brookins, Roland Garros, and Louis Paulhan

Captain Wilbur and Charles K. Hamilton twenty five years ago looking over the design of the biplane *Eagle*

By CAPTAIN HORACE B. WILD

BY HOPPING a ride on a hayrack, I took part in a pioneer experiment that led to the airplane.

One morning in 1896, I was standing in front of a Chicago fire station when an old-fashioned hayrack clattered past with a white glider stretched out lengthwise on it. I ran down the street, jumped on the back of the wagon, and rode with the driver all the way to Miller, Indiana, thirty miles away.

There the glider was delivered at the sand hill camp where Octave Chanute and his assistants were making their historic tests that laid the foundation for the Wright brothers. When the wagon went back that day, I stayed behind and became cook and chore boy for the experimenters.

For several months we tested queer machines. Some had one wing, others two, and one weird craft, which we dubbed *The Flying Staircase*, was fitted with five planes ranged one above the other. At first we had a greased track down the side of a high dune for launching the gliders. Later they were taken into the air by running downhill with them into the wind.

Chanute, a friendly little man with pink cheeks and a white goatee, was as enthusiastic as a boy over the machines we built. Before he took up aerial experimenting as a sport and a study, he had achieved world fame as a bridge builder and engineer. Chanute, Kansas, was named in his honor. He was the first to span the Missouri River and he was the man who laid out the Chicago Stock Yards.

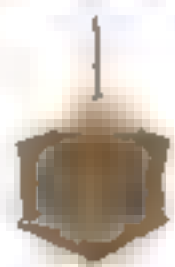
His bridge building experience aided him in designing the most successful of his gliders, a biplane braced with piano wire in a bridge truss—the system still employed in many modern planes. Only the other day, I flew a fast biplane that had its bracing wires arranged essentially the same as that crude glider that I saw fly for the first time in the wilds of the Lake Michigan dunes.

Octave Chanute was the first of many pioneers of aerial history that it was my good fortune to know intimately. On one of his trips to visit the Wright brothers at Dayton, Ohio, before they flew at

Glenn Curtiss, in center, Mrs. Curtiss and Capt. A. W. Stevens, right, at the dedication of a memorial to the Wright brothers

A Blériot monoplane that was owned and flown by Earle T. Ovington, soon after Blériot's famous flight across the English Channel. Note the lucky doll hanging in the fuselage of the plane. Without doll, Ovington would not fly.

This monoplane, built according to designs used by John J. Montgomery in a glider flew easily at the speed of sixty miles an hour when powered with a 1911 engine, thus proving Californ's pioneer right.



An echo out of the past is this picture of Lincoln Beachey, in his queer looking biplane, rounding a pylon at top speed during the famous aviation meet at Chicago in 1911. Note the ladderlike affair sticking out in front of the planes, upon which the aviator rode in a hazardous position.

Kitty Hawk, Chanute took me along. I remember we spent most of the time on the train debating the relative merits of airships and airplanes. I upheld the side of the gas bags. Even after the Wrights flew in 1903, I didn't have a great amount of faith in heavier-than-air machines. It was not until I saw Blériot fly the English Channel that I was converted.

When we arrived in Dayton, we found Wilbur Wright tinkering with a bicycle in the little shop at 1027 West Third Street. At that time there wasn't an airplane in existence and more than ninety-nine percent of the inhabitants of the globe thought there never would be.

When Wilbur had wiped the grease from his hands and called Orville, Chanute went over their aerodynamic tables and calculations with them. He was greatly impressed and congratulated them several times. On the way home he told me they had made remarkable progress.

"It is only a matter of time," he said, "before they will have a motored machine that will fly."

In the same neighborhood with the Wrights, there lived a mischievous boy in knee-pants named Walter Brookins. He used to scrape the whitewash off the windows of the shed where the Wrights were working so he could look in, and, when they were away, he would try to pry open the padlocked door to find out what was going on. Orville and Wilbur would take turns chasing him around the block, but he would always come back.

Later, after the airplane that had its beginning in the shed with the whitewashed windows had proved a success, Walter Brookins became one of the most famous of the Wright pilots. In 1910, he set a world's altitude record at Indianapolis with his clattering chain-driven biplane climbing to a height of a little less than 5,000 feet. He has lived to see the present mark at eight times that figure.

The Wright brothers carried on their flying experiments at Kitty Hawk, among the sand dunes of the North Carolina coast. At the other extreme of the country, in California, another pioneer wrestled with the same problem. This was John J. Montgomery, a physics professor at Santa Clara College, near San Francisco. His 600-foot glider flight, made in 1884 and the first ever accomplished, should place him in the front rank of aviation pioneers.

ON a trip to the West Coast in 1906, I spent several weeks with him and saw one of his gliders ridden by a profes-

sional parachute jumper It rose to a height of 4,000 feet attached to a hot air balloon, where it was cut free and circled safely to earth

Montgomery was a great hunter He used to spend days in the California mountains, most of the time watching birds instead of killing animals. I accompanied him on one of his hunts. We lay on our stomachs all one morning in some bushes at the top of a cliff that jutted out over a gorge, watching buzzards soar past. The birds met an up-current near the cliff and they would ride past on silent wings, often less than a dozen feet away In fact, I spent so much time with Montgomery that I had to telegraph for money to get home

A LIGHT gasoline motor was all he needed to turn his glider into a successful airplane. We proved that when several of us in Chicago built a Montgomery-type tandem plane in 1910 and fitted it with a small Bates air-cooled engine. It flew like a streak, sometimes touching sixty miles an hour, but the landing gear was unsatisfactory. After every flight we washed out the wheels and struts

I still have the thin-bladed wooden propeller we made for that early machine This was only one of many kinds of "aerial screws" I used in my forty years in the air. They ranged from the clumsy and frail propellers of cloth stretched on spruce frames that pulled along my early dirigible to the blades of gleaming steel that circle at the nose of my modern plane. This advance in propeller design is a factor often overlooked in giving credit for present-day airplane efficiency and speed.

Of all the flying pioneers, the one I knew best was Glenn H Curtiss. I met him under singular circumstances, in December, 1903—only a few days after the Wrights had made the first airplane flight of history at Kitty Hawk. I was with Captain Thomas S. Baldwin, then the most famous aeronaut in America. We were looking for a motor for Uncle Tom's dirigible, *The California Arrow*

We had first tried out the *Arrow* at Chutes Park, Los Angeles, with a propeller turned by bicycle pedals. We pedaled until we were out of breath. Then the ship would drift off like a balloon. Finally, Uncle Tom let out the gas and said he had had enough pedaling to last a lifetime and if he couldn't get a good motor to do the work, he would stay on the ground. So we went to New York to look for an engine

At the old Aero Club of America we were told a young fellow named Glenn Curtiss was turning out a remarkable little engine for motorcycles at Hammondsport, New York. We took the upstate train to Bath. There we had a four-hour wait for the shuttle train to Hammondsport. We wrote a telegram to Curtiss telling him what we wanted and asking him to meet us at the station. The message totaled sixty words. Our money was running low so we spent the whole four hours trying to whittle it down to ten words, so it would go at the regular rate.

IT was late in the evening when we arrived. The only person in sight was a man with a long beard sitting on a baggage truck. Captain Baldwin approached the man and asked

"Can you tell me where I can find Mr. Glenn H. Curtiss' factory?"

"That shed on top of the hill is where Glenn works," the man said, jerking his thumb over his shoulder

We plodded up the dirt road and knocked on the door Someone inside called "Come in." We opened the door and saw an elderly man sitting by a little pot-bellied stove, with a lantern on a table beside him. Baldwin said

SIR I am Captain Thomas Scott Baldwin. Am I addressing Mr. Glenn Curtiss?"

"No. I'm Glenn's father He went down to the station to meet you. I don't see how he missed you."

Just then the door creaked and we turned around. Curtiss was standing in the doorway, looking a little sheepish

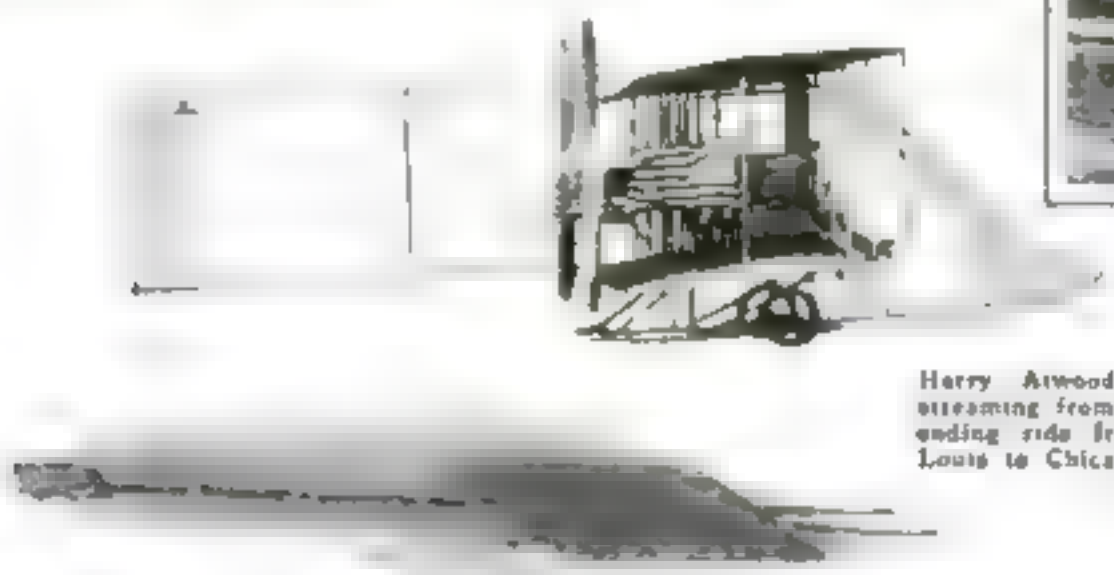
"I saw you," he explained "but I was afraid I might be mistaken so I didn't say anything."

He had trailed behind us all the way from the depot. We stayed overnight and when we left, Curtiss had an order for a two-cylinder airship motor It was shipped to California packed in cotton batting

That order started "G. H." on his aviation career. I saw him many times afterwards, flew one of his early biplanes, traveled with him, and, only a few weeks before his unexpected death, rode with him in a huge Curtiss "Condor" biplane from Albany to New York to celebrate the Twentieth Anniversary of his his-

(Continued on page 131)

Remember this kite-like biplane? It was in this machine that Beachey won his honors at Chicago.

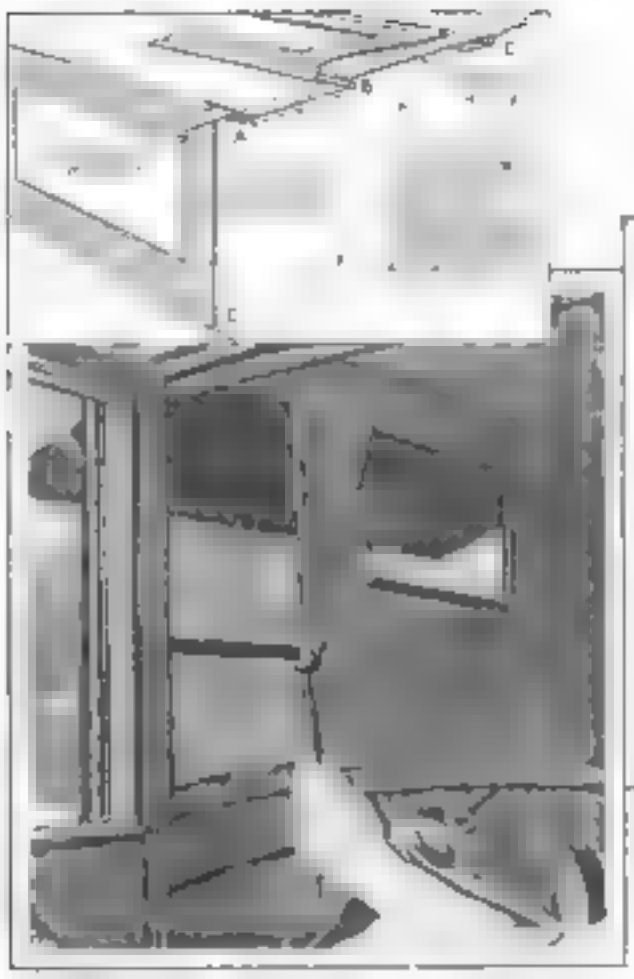


Harry Atwood flags streaming from struts, ending ride from St. Louis to Chicago, Ill.

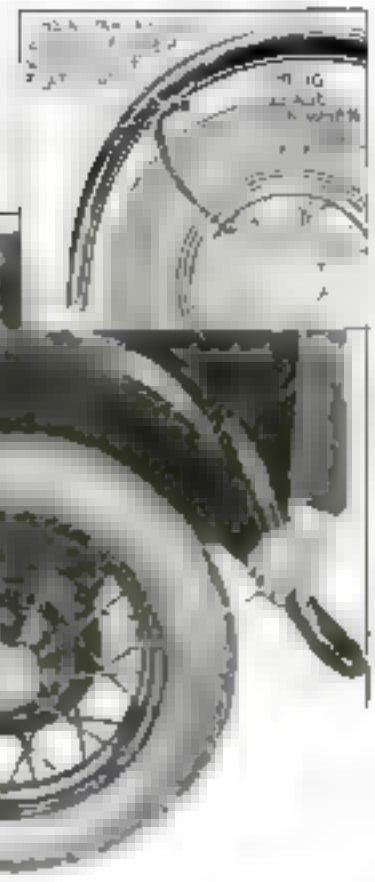
Here is another machine built by Captain Wild along the lines of a Montgomery type of glider This plane, when properly powered, also flew.

New Ideas That Give Your Car Comfort and Riding Ease

Engineers, laboring to increase auto's efficiency, now add silencer, flat tire indicator, safety curtains, and build car without a chassis.



Danger of injury from flying glass in a collision is reduced by a curtain that automatically drops between driver and windshield at the instant of impact. Diagram at top shows how the force of the [illegible]



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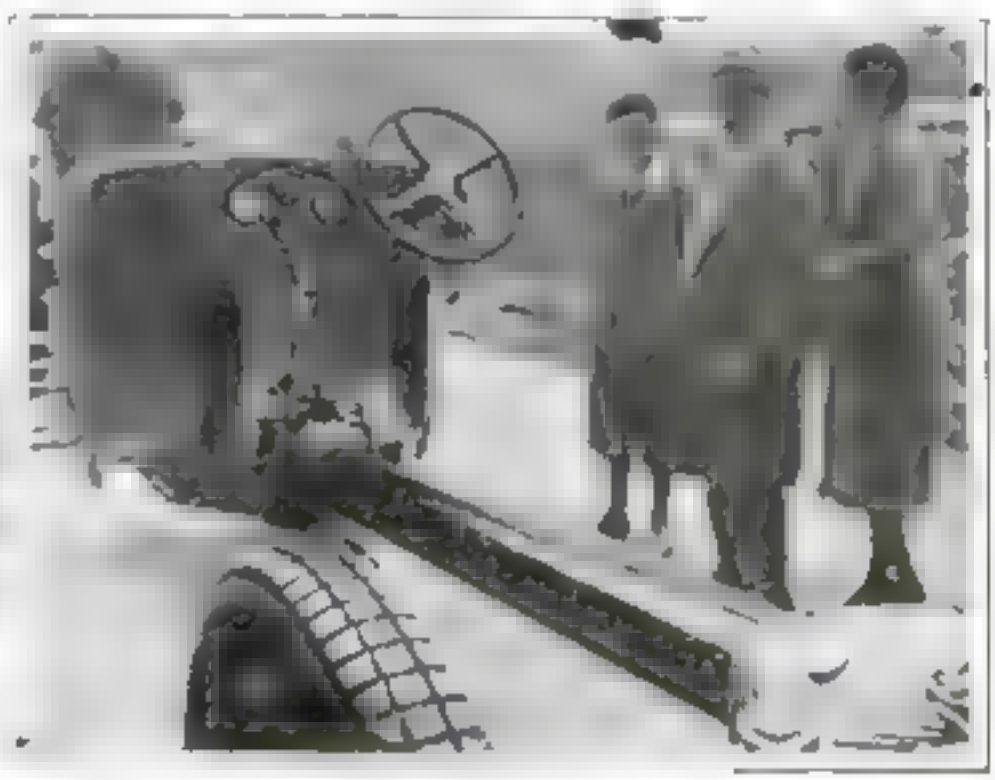
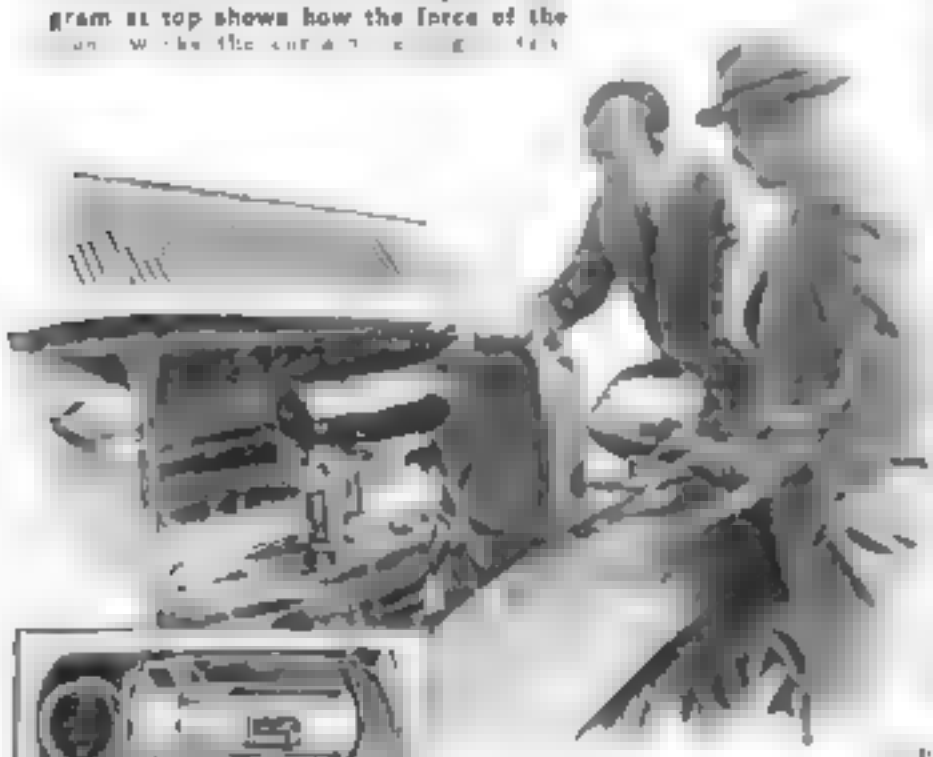
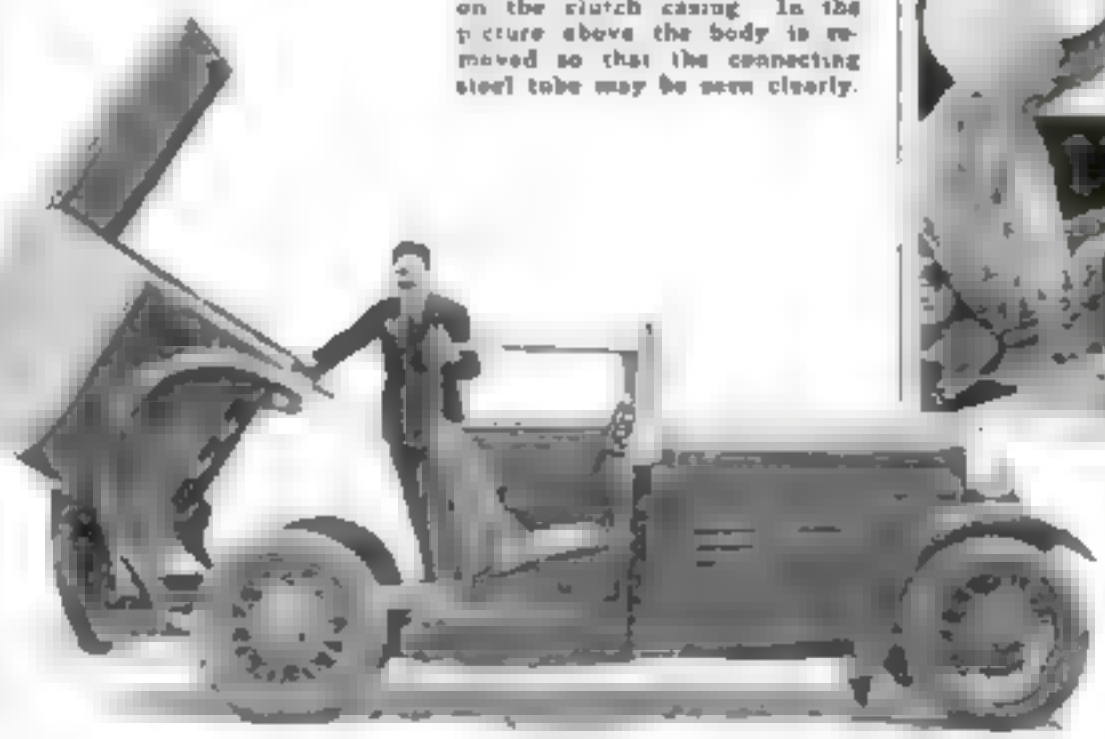




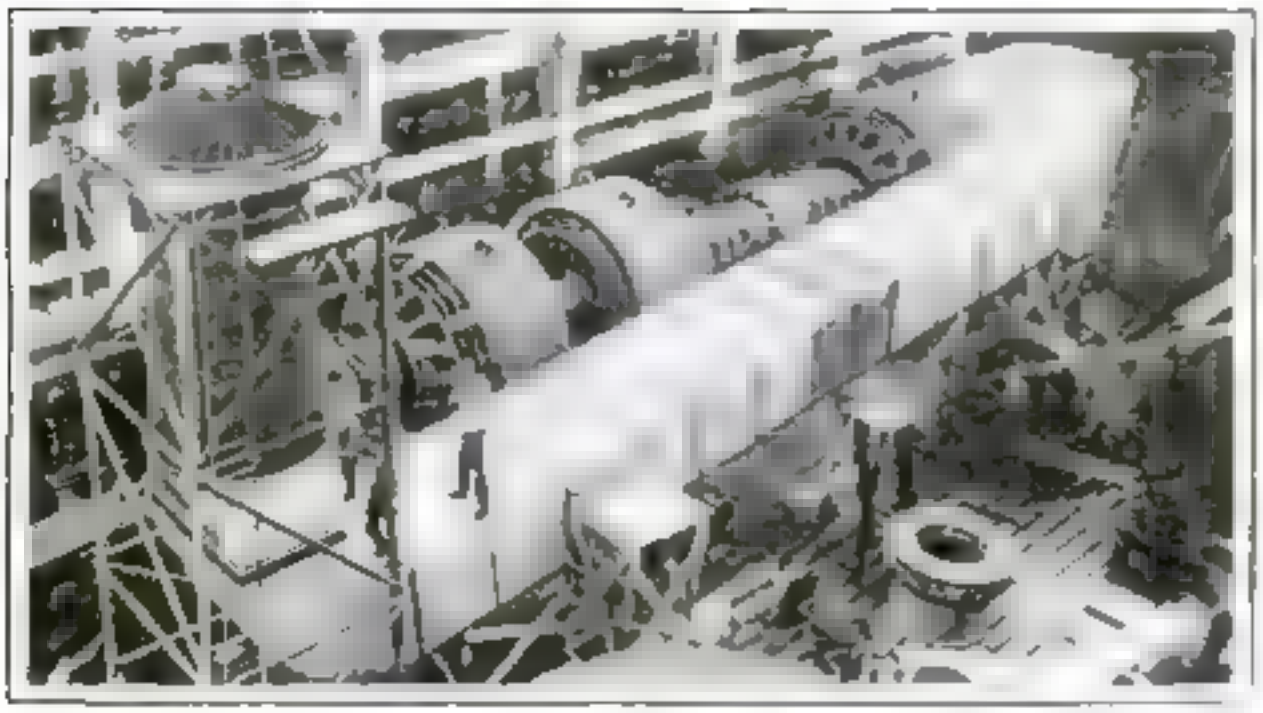
Carburetor intake silencer makes a car's engine practically noiseless. Built into the cylindrical shaped device are multiple tubes and chambers, as seen in the inset which neutralize the sound waves coming out of the carburetor and so eliminate power roar. It also is an air cleaner.

[illegible] place of a frame and an ordinary chassis a new car has a big steel tube connecting gear case to rear axle. The forward end of the twelve-cylinder motor is carried on the front axle and the cowl and dashboard are mounted on the clutch casing. In the picture above the body is removed so that the connecting steel tube may be seen clearly.



To facilitate repairs on chassis, an automobile body has been designed, as seen at right, that is hinged at the back so that it is easy to raise it out of the way. In driving position it resembles any ordinary body. Reduction of garage bills is claimed as one of its merits.

You can step out of your car into the rain in safety if you carry this new umbrella that fastens to a convenient place beneath the top. It is so secured that it does not rattle and the material of which it is made is so resistant that it does not mar easily.



TRAINLOAD OF AIR COOLS MOTORS

A BLAST of air, equal every minute to the volume displaced by a ten-car train cooled a set of motors under test recently at the East Pittsburgh, Pa., works of the Westinghouse Electric and Manufacturing Company. The test was made on the most powerful motors ever to be applied to a single pair of rolls in a steel mill. It was conducted to find whether they could be kept cool under the terrific punishment they must undergo daily

The picture above shows the crooked duct through which a huge propeller fan pushed a "trainload of air a minute." In service, air to cool the motors will be forced through them from [illegible] floor and out through holes [illegible] eliminating the ducts seen in the photograph. Modern knowledge of [illegible]ers has cut in half the amount [illegible] required to force through du[illegible] quantity of air required

MIX DOUGH UNDER VIOLET RAY

THE extent to which science is taking part in the simple tasks of everyday life is shown in this weird looking photograph of an ultra-violet ray lamp attached to a large mechanical dough mixer. The lamp was exhibited at a recent display of baking machinery that was held in Agricultural Hall, in London, England.

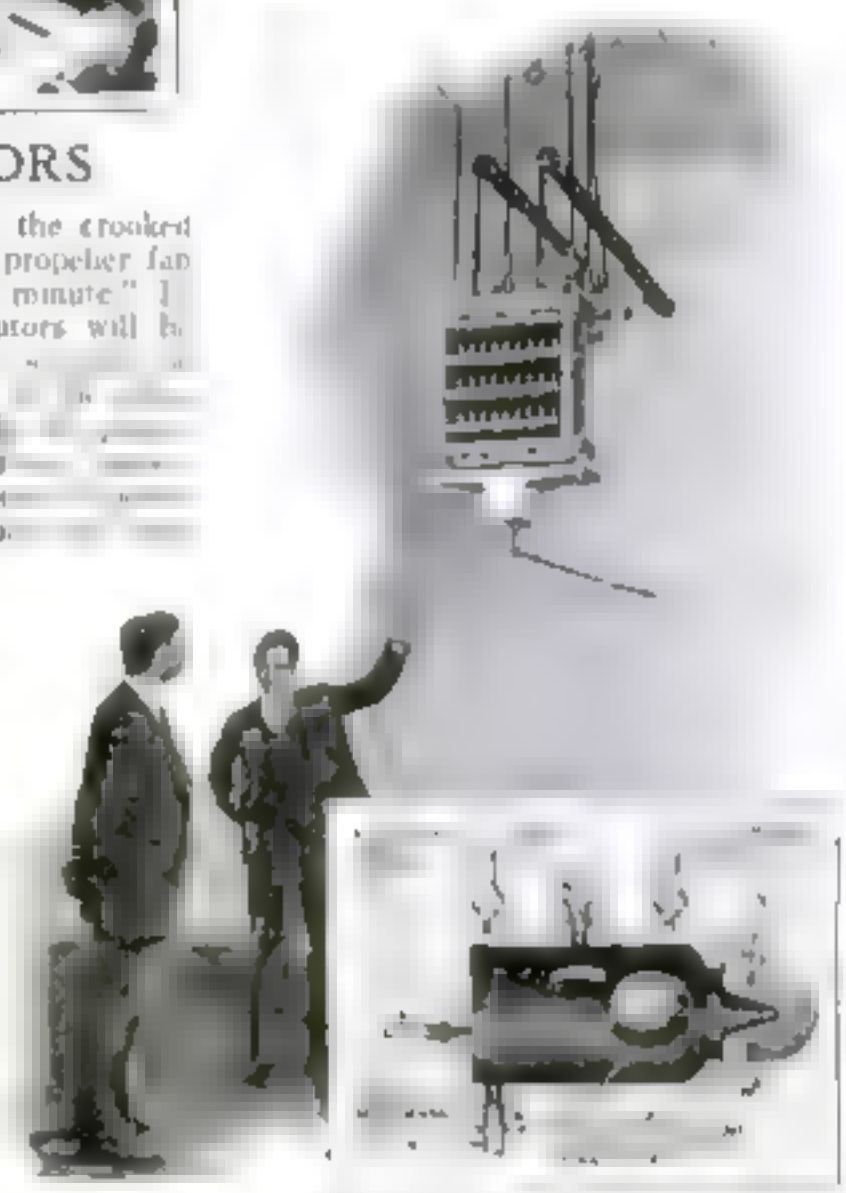
Rays from this lamp, the same as those used for the treatment of various diseases and to obtain sun tan, are applied to the dough while it is being mixed. Bread made from it is said to be lighter in weight and much whiter than bread made from dough mixed in the ordinary way. It is believed that the use of the rays in this manner may add to the nourishing and health restoring value of the bread.

Bakers at a London exhibit saw this bread mixer in which the dough was worked under ultra-violet rays

NEW AIR COOLER HAS AUTOMATIC CONTROL

AN AUTOMATIC attachment on the latest unit cooler for home or factory enables it to deliver the amount of chill that is needed at all times without supervision.

Radiator fins in the new unit give a cooling surface as effective as three tons of pipe. An electric fan blows air between the fins and into the room while the refrigerant circulates inside each of the hollow fins. A ball-and-float attachment, by operating an automatic electric valve, replenishes the cooler as often as the level of liquid in it drops.



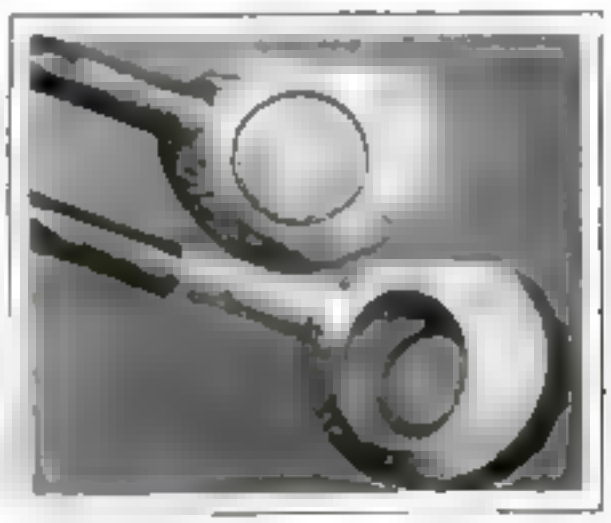
Tiny unit air cooler which has the power of three tons of pipe. The diagram shows its parts with the automatic control valve.

HOLE IN GOLF CLUB PICKS UP BALL

DOUBLY useful is a new golf club that contains a device for picking up balls. To retrieve a ball from the ground or cup it is unnecessary to stoop. When the user sets the club on the ball, the sphere is forced into the circular opening. A ring of elastic material keeps the ball from falling out. This "lazy man's club," a British invention, is a putter, and the conventional shape of such a club's head has been altered to incorporate the lifting attachment.

In the accompanying photograph, the lower picture shows the hole at the center of the club's head, with the elastic ring that retains a ball after it is picked up. The upper view shows the club holding the ball snugly in the hole. A touch of the fingers from beneath pushes it out.

The material of which the club head is made is heavier than that ordinarily used for the purpose, to make up for the hollow inside.



This lazy golf player's putter has hole in its head with which the ball can be lifted.

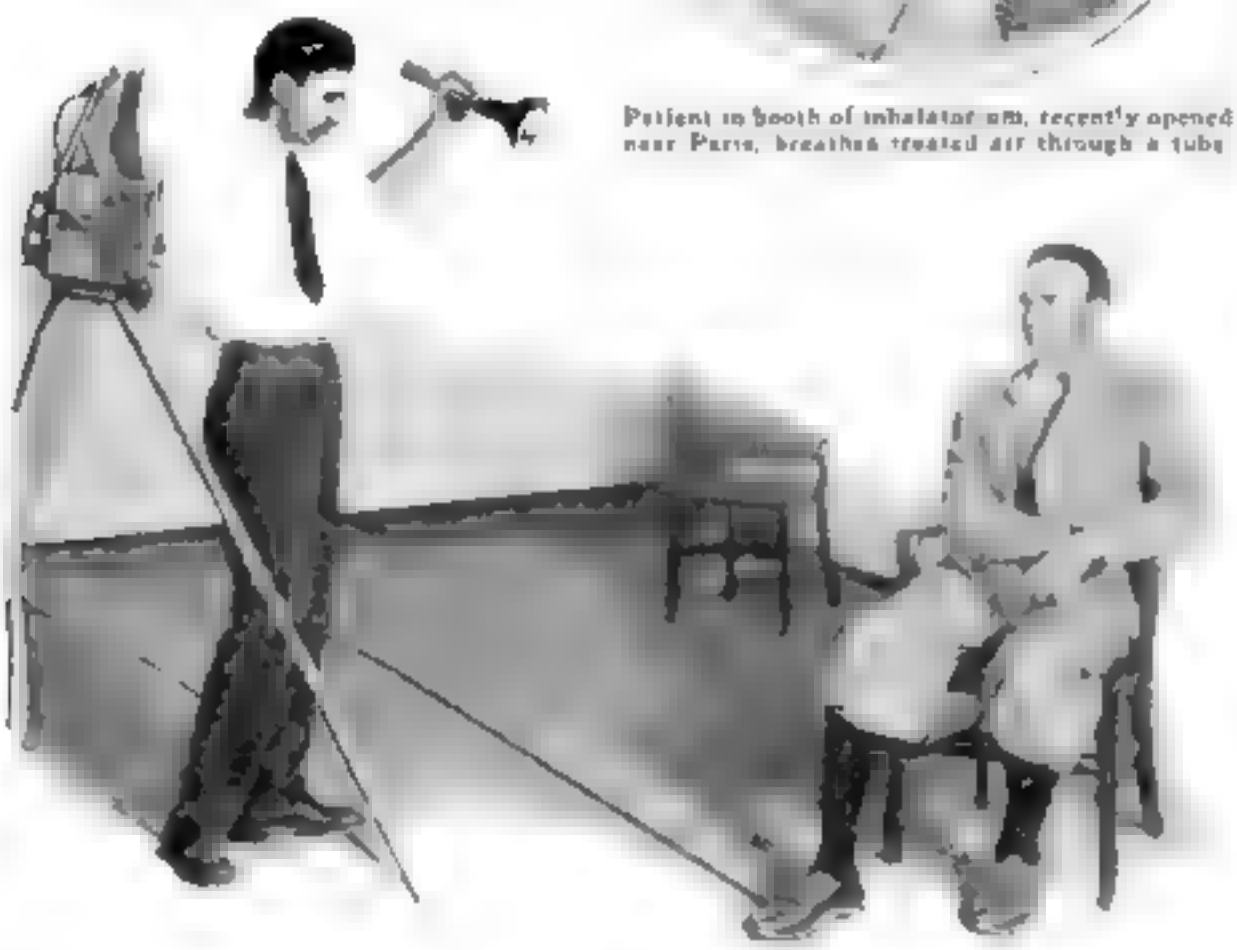
TREATED AIR NOW USED TO CURE TUBERCULOSIS

TUBERCULAR Frenchmen no longer have to go to the mountains for treatment of their lungs. Doctor Arnold, a French physician who has made a twenty-year study of tuberculosis, has recently completed the first "inhalatorium" for treatment of consumptives near Paris. Patients inhale specially treated air through tubes, eliminating the necessity for them to be exposed to the rarefied air of mountain tops in winning their way back to health.

In Doctor Arnold's institution each patient sits in a small booth and breathes in health-giving drafts. The treated air has a cleansing action on their lungs and helps to heal lesions that have formed. The small picture shows a patient in an inhaling booth, while the large photo shows an aisle between booths with a nurse regulating the vaporizing apparatus to suit the patient. Conical mouthpieces [illegible] booth serves [illegible] speaking tube [illegible] and [illegible] patient [illegible]

Patient in booth of inhalator am, recently opened near Paris, breathes treated air through a tube

On each side of this long aisle are booths for [illegible]



NEW FLASHLIGHT WORKS IN BULB

AN INNOCENT looking electric light bulb, which outwardly resembles any modern lamp, behaves very differently when the switch is turned. Instead of a steady glow, there is a sharp, dazzling flash of light so powerful that an excellent photograph may be taken—then darkness.

Flashlamps of this new type, recently developed, are expected to revolutionize flashlight photography. Instead of exploding loose powder in the air, as formerly, the flash is confined entirely *within* the bulb. As a result it cannot set fire to draperies, and is odorless, smokeless, and noiseless. Amateur photographers may use the bulbs for night photographs at home. They also enable camera men to make flashlight photographs where they have never been taken before—in trains, airships, theaters, and even under water.

The lamp is filled with oxygen at low pressure. A crumpled piece of very thin aluminum foil encircles the filament. When the light is turned on, its filament instantly ignites the metal foil. The flash is over in the short space of a hundredth of a second. Each flash bulb can be used only once. Either battery or house current may be used, and one type of holder uses flashlight cells.

STRANGE DISEASE HITS TRAIN DISPATCHERS

NYSTAGMUS, a new occupational disease, has been discovered by the Industrial Health Conservancy Laboratories, of Cincinnati, Ohio. This organization recently examined five hundred train dispatchers, two thirds of whom were found to be afflicted with involuntary shifting of the eyeballs, first symptoms of the new disease. It is believed to be caused by poor light and eyestrain resulting from following moving objects with the eyes.

TELEPHONE SYSTEM NOW PLUGS IN WALL SOCKET

Now you can carry your telephone from room to room and plug it into wall sockets like a bridge lamp. This new system, broadening the telephone service until it reaches every room in a house, has recently been introduced by the Bell System for domestic use. It is particularly designed for large dwellings.

The "plug-in" type of telephone is usually installed as part of a private exchange system for the home, centering in an automatic switchboard about the size of a clothes closet. Calls from one part of the house to another as well as calls coming from the outside may be made and received by it.

New plug-in telephone wiring extends the service, like exchange board, to each room in house.

BLAZING METEOR HITS CAR'S HOOD

OUT OF the sky, a blazing meteor came hurtling toward an Indiana motorist, a few nights ago. It missed his head by two feet and smashed through the car's hood and radiator. Then it struck the road and rebounded into a cornfield.

Lawrence Swank, seventeen-year-old filling station attendant of Crawfordsville, Ind., was the survivor of this amazing experience. Driving home alone, he saw a flash, and heard the missile strike. His first thought was of bandits. Terrified, he sped to Crawfordsville. There he found holes in his car almost as large as a man's fist!

Other residents told of seeing a huge meteor flash across the sky. Evidently it exploded and one fragment never recovered hit Swank's roadster. A tiny chip imbedded in the car's generator proved of meteoric origin. Next day another twelve-inch piece, illustrated here, was found a mile from where Swank's car was hit.

Drawing shows how the meteor crashed through hood. At right, a twelve-inch piece of meteor found more from where Swank's car was struck

Lawrence Swank, Crawfordsville, Ind., points to holes made in his car by meteor fragment.

WHITE DISK APPEARS IF LIGHTNING HITS TOWER

LIKE a rural mail box, that shows a flag if a postman leaves mail, is a new electric device that works when lightning hits a transmission line tower. Ordinarily its face is dark. A bolt of lightning, however, operates an electric release that allows a white disk to swing into view. When this "surge indicator," developed by General Electric engineers, is mounted on a tower a lineman can see at a glance whether a tower has been struck recently and its insulators may need repairs.

MACHINE SHUFFLES AND DEALS BRIDGE CARDS

A NOVEL device, recently perfected by L. A. Lux, of Cleveland, Ohio, shuffles a pack of cards and deals four hands of bridge in twenty-seven seconds. The cards are placed in the little machine between a spring and pair of rollers. Turning a crank, the dealer shuffles the cards, and the hands are dealt into four separate compartments, as shown in the picture.

Users of this machine have found that it does not wear out cards so rapidly as does hand shuffling and dealing. When bridge hands are dealt mechanically there is also no chance to question the fairness of the dealer.

TEST FLOOR COVERINGS BY WALKING ON THEM

ENGINEERS of the Bell Telephone Laboratories recently hit upon a method of testing specimens of floor coverings that were being considered for use in telephone booths. Samples of the materials were laid side by side on the floor of a corridor for passers-by to walk over them. Kept under observation, the wearing qualities of the different materials, all of some rubber composition, were noted.

To find out how much wear rubber flooring would stand, samples were set in a hal.

NEW SUBMARINE OF EIGHTY KNOT SPEED PLANNED

Henry Fleur of San Francisco exhibits the six-foot model of his recently invented submarine. He points to the fins used in submerging it. Inset shows the boat, rocket driven, in surface test.

A SUBMERGED speed of eighty knots is predicted by Henry Fleur of San Francisco, for a novel submarine which he has planned. The inventor is shown standing beside a six-foot model of the craft with which he hopes to revolutionize subsurface navigation.

Compressed air furnishes the motive power for this boat and drives it ahead by drawing water through the bow and ejecting it at the stern. Diving is accomplished by jets of water and air from vents in fins shown on the sides of the model in the illustration above.

Fleur believes his craft to be capable of a speed of one hundred and nineteen knots on the surface and declares it will have less vibration and greater safety than submarines now in use.

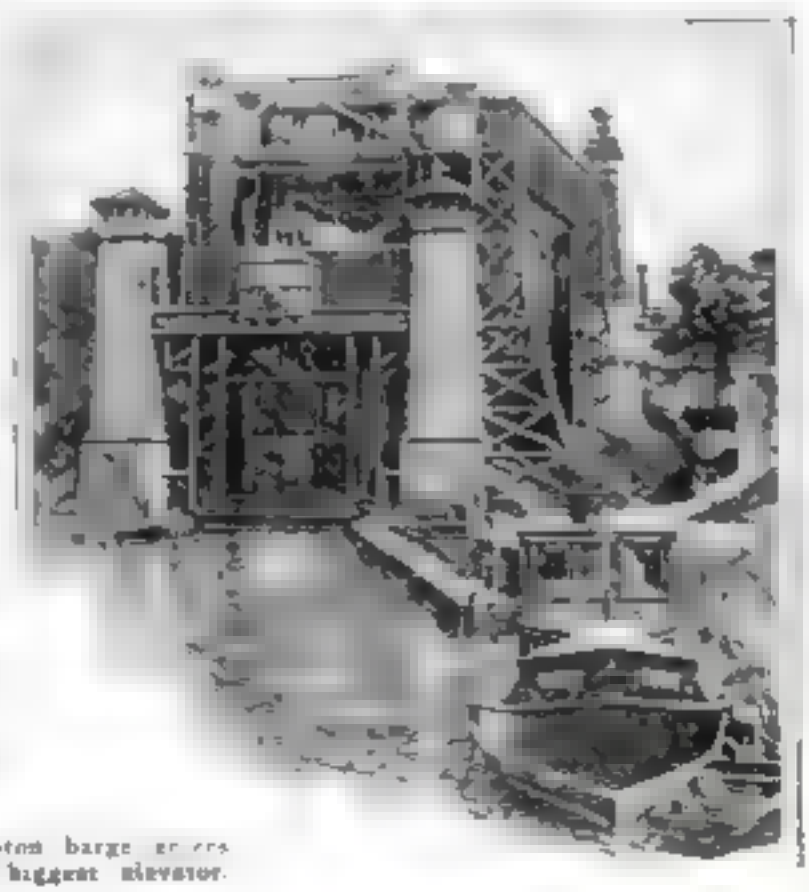
In a recent surface test of the boat on Spreckels Lake, Golden Gate Park, San Francisco, Calif., a rocket was used to propel it. Thus energized, it crossed the lake in ten seconds. Fleur says his plans have been favorably received by naval officials and boat experts.

BIGGEST ELEVATOR RAISES SHIP

THE gigantic new elevator on the Berlin-Stettin canal in Germany was opened recently. This elevator will raise 1,000-ton barges 118 feet in the air. Barges are towed into a huge tank which is closed after them and the tank is then moved to the desired level, being counterbalanced so perfectly that but three hundred horsepower are required to lift it with a barge inside.

Four old locks on this canal have been replaced by the use of the elevator, which is the largest of its kind in the world. It cost six million dollars to build.

A more detailed account of its construction, with an explanatory diagram of its operation, was published in an earlier number of this magazine (P.S.M., Sept. '30, p. 43).



A 1,000-ton barge enters world's biggest elevator.

MAGNET ON FRONT OF CAR PICKS UP NAILS

An electromagnet attached to front bumper prevents punctures by picking up all nails.

DISGUSTED with the number of punctures he was having, Ted Miller, of Portland, Oregon, rigged an apparatus on his car that picked up nails and sharp bits of metal before they damaged his rubber. Electromagnets were attached on either side of the front bumper and connected with the car's generator.

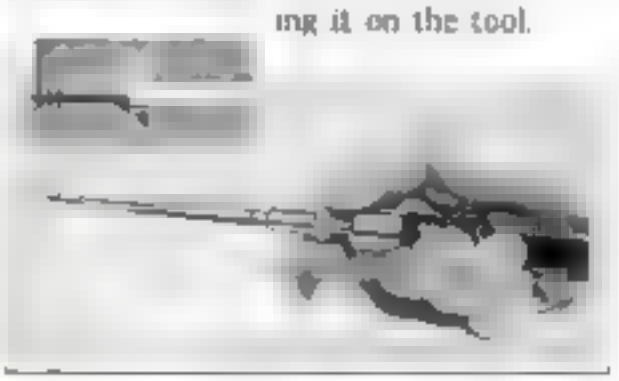
He found that when traveling at a speed of twenty-five miles an hour the magnets picked up objects as large as nails from the car's path. As soon as the motor was stopped the metal particles would fall off.

ROBOT POWER PLANT

A BRAZILIAN official recently closed a switch in an electric substation in the town of Juiz de Fora, Brazil, and put the first automatic hydroelectric plant in South America in operation. Five miles away, in a power house in which there were no human attendants, turbines began to spin

THIS TOOL HOLDS SCREW AND DRIVES IT HOME

DRIVING screws in inaccessible locations is easy with a new tool that holds the screw on its own point. This screw driver has a slot down the length of its shank. A lever moves in or out of the slot in response to pressure on a ring below the handle. When a screw is placed on its point the ring is moved downward, causing the outer end of the lever to press against the inside of the screw slot, holding it on the tool.



This screw driver has movable lever to hold screw while it is being started in the hole.

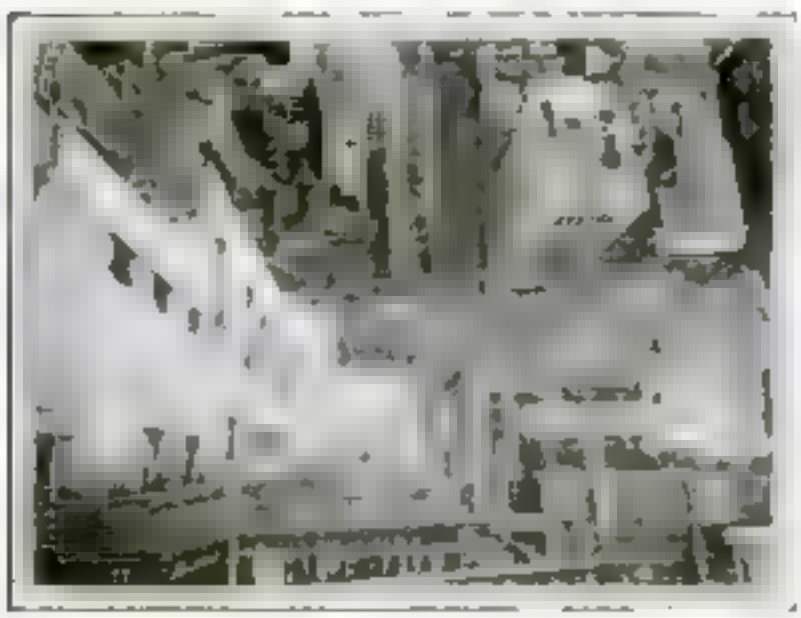
Higher *than* Man Ever Built Before

UP TO A NEW WORLD'S RECORD A worker on the Empire State Building in New York rides past the 1 046-foot level of the Chrysler Building's spire, in background.

THE FLAG GOES UP It signals completion of the steelwork on the 1 252 foot Empire State structure. The building will have 85 floors, plus a 14-story tower.

NOW THEY USE SAFETY NETS As records fall for high towers, the innovation shown at left has appeared. This net, at the twenty-ninth floor of the Empire State, will catch men who slip.

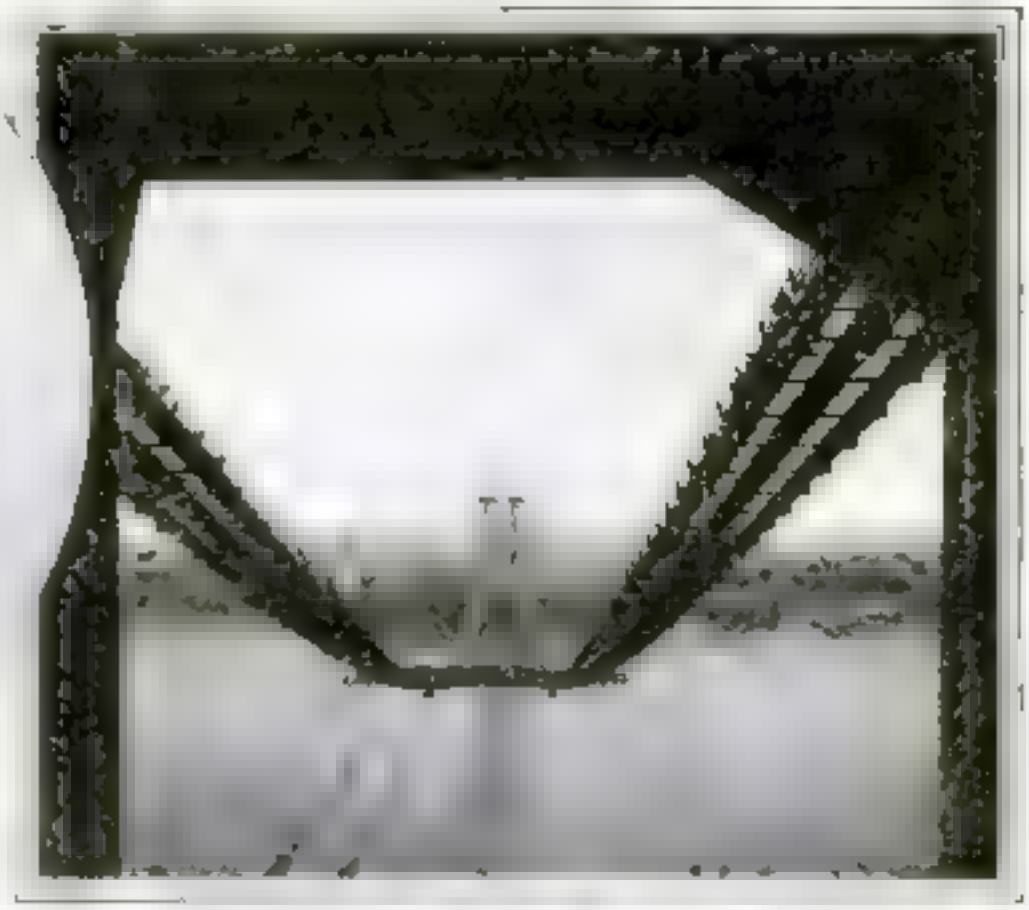
MEN WHO DEFY DEATH A misstep means a plunge and eternity for these daring workers on steel skyscraper skeletons. Below, what they see when they look down.



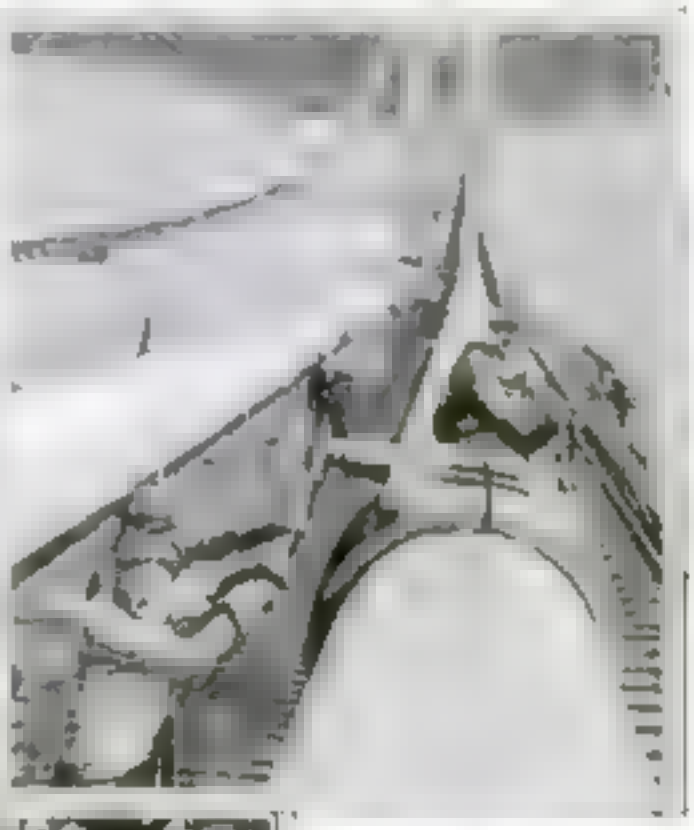
A LOFTY PERCH There is more than a fifth of a mile of pretty empty space between Carl Russell, steel worker on the Empire State Building, and the street. Yet he waves a greeting, waiting for girder

Views of World's Biggest Bridge

SHOOTING THE CANTILEVER BRIDGE



WHERE A HIGHWAY WILL SWING ACROSS [illegible] New York and New Jersey



BANDING CABLES

When the [illegible] were finished [illegible] A [illegible] machine [illegible] which [illegible] the bands [illegible] Two [illegible] permanent [illegible]

THEY DON'T EVEN HANG ON

[illegible] the [illegible] about a year [illegible] 3,500 [illegible] 6,000,000 [illegible]

NEW HELICOPTER HAS SIXTY BLADES IN WING

IN THE constant search for a means of flight straight up or down, a California inventor has turned to a queer type of helicopter, by means of which the machine can fly upward as ordinary machines fly horizontally. This helicopter has an umbrella-shaped propeller about ten feet in diameter, its sixty blades having a total area of 135 square feet

This propeller has an up and down movement of two feet for each revolution. If the machine rises the propeller, after the desired altitude is reached, can be tilted to an angle of about forty-five degrees, and used for horizontal flight A sixty-five-horsepower motor drives the propeller through a system of gears.

AIRPLANE MOTOR DOESN'T MISS IN WATER TEST

ROARING under wide-open throttle, the powerful note of this transport plane's motor never missed a beat during a twenty-eight-minute water test recently held in Chicago to demonstrate the value of its new waterproofing devices. Special coverings were placed over spark plugs, wires of the ignition system, and magnetos. Except for these provisions the plane was fitted with standard equipment.

Water at forty-five pounds pressure from a two-inch main through eight large spray heads imitated about the worst rainstorm a ship might be expected to meet. The spray heads were set in a four-foot circle just in front of the plane's propeller, so the motor received the full force of water passing through them.

An umbrella shaped wing with sixty blades may give this helicopter power to rise vertically

STUDENT'S GLIDER CAN BE POWERED TO FLY

DESIGNED as an aid in teaching flying, this little machine, shown below, known as the Sunbeam Pup, was built at Los Angeles, Calif It is so constructed that, with motor and fuselage removed, it can be flown as a glider Students are taught motorless flight in it as soon as their ground courses have been completed. When they have mastered the controls and familiarized themselves with the A B Cs of aerial work the motor is installed and they are trained for mechanical flight in the same machine in which they learned to glide.

With motor installed the Pup weighs but five hundred pounds. It will soon be used by Romer G Weyant in an attempt to establish a new altitude record for light planes. A forty-horsepower motor gives it a top speed of eighty miles an hour Pilots who have flown this craft, which they call the "flying bathtub," say that it performs equally as well either as a glider or a power-driven plane.

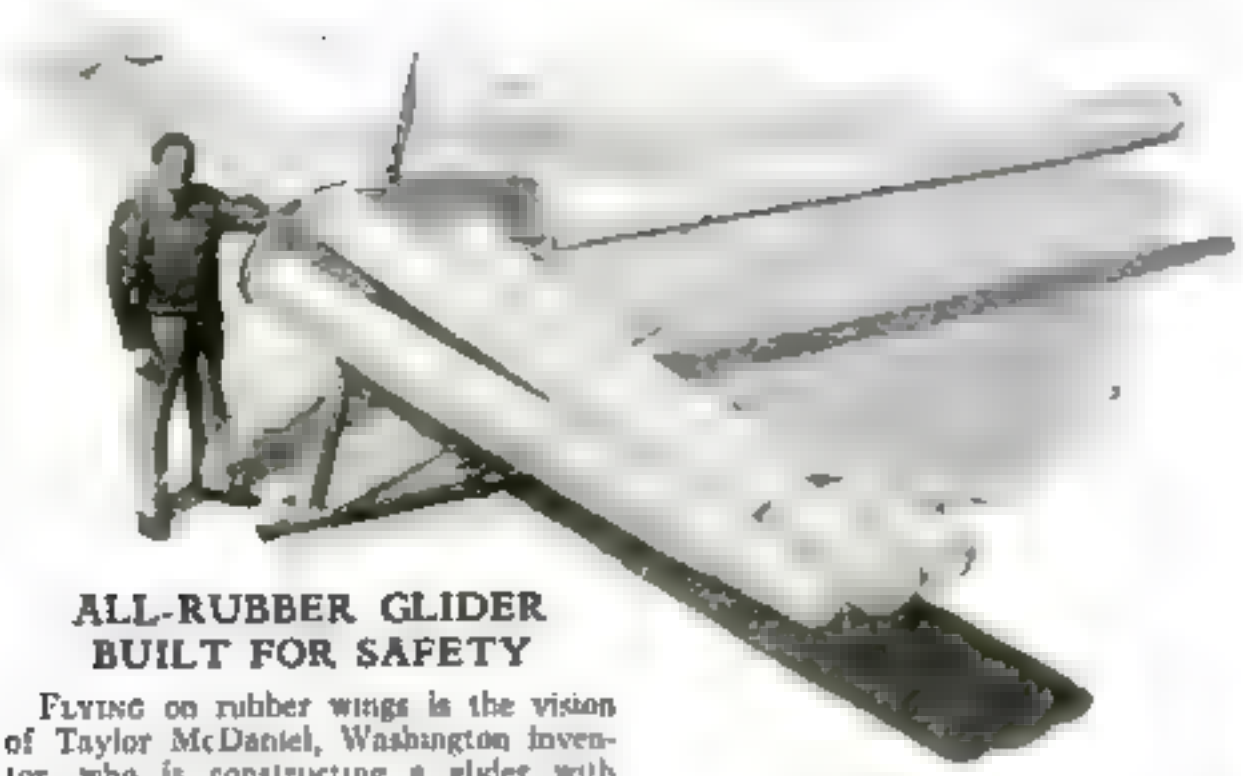
In this new type glider, which has a detachable motor, R. G. Weyant, who is shown above equipped for an altitude flight, plans a new high-flying record.

PILOTS CROSSING ANDES NEED OXYGEN TANK

WEARING some of the equipment usually carried only by seekers after altitude records, William Crosswell, famous test pilot, is testing the oxygen equipment on a plane for the only air line whose ships must be so fitted. The plane was built for the line that carries mail over the Andes Mountains in South America between Santiago, Chile, and Mendoza, Argentina a distance of one hundred and fifty miles as the crow flies, but including a 23,000-foot climb over the mountains. At this height the use of an artificial oxygen apparatus becomes imperative, as otherwise the pilot probably would lose consciousness.

Apparatus of this sort is worn by pilots who take planes, 23,000 feet up, across the Andes.

Rare Pictures Tell Story of Latest Events in Air



ALL-RUBBER GLIDER BUILT FOR SAFETY

FLYING on rubber wings is the vision of Taylor McDaniel, Washington inventor, who is constructing a glider with which he hopes to demonstrate the practicability of his idea. It is built entirely of air-inflated rubber tubing, there being no steel or wooden members in its framework. Three hollow rubber tubes are used for wing spars, and a larger rubber tube carries the tail with rudder and elevator. These tubes, when properly inflated, did not bend appreciably when a 200-pound man walked on them.

The inventor believes that his idea will make safer, cheaper, and lighter planes. His glider, when completed, will weigh but 125 pounds.

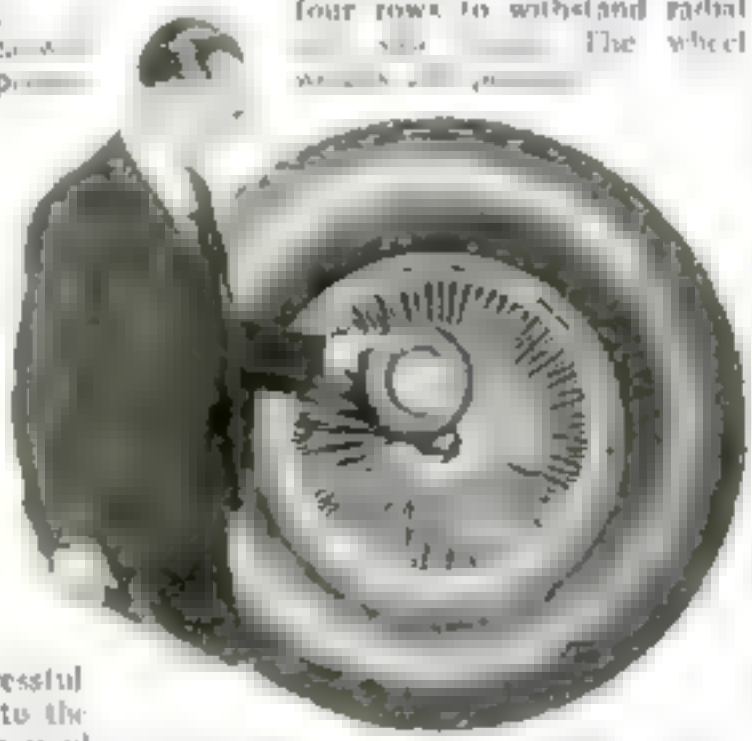
TEST CATAPULT TO LAUNCH PLANE

THIS scene at a British flying field shows an airplane about to take off from a catapult mounted in a test pit. The Royal Air Force is experimenting with different types of catapults for use on war vessels. Before being placed on ships, these devices are tried out on shore, where the plane has but a few feet to fall if the launching proves unsuccessful.

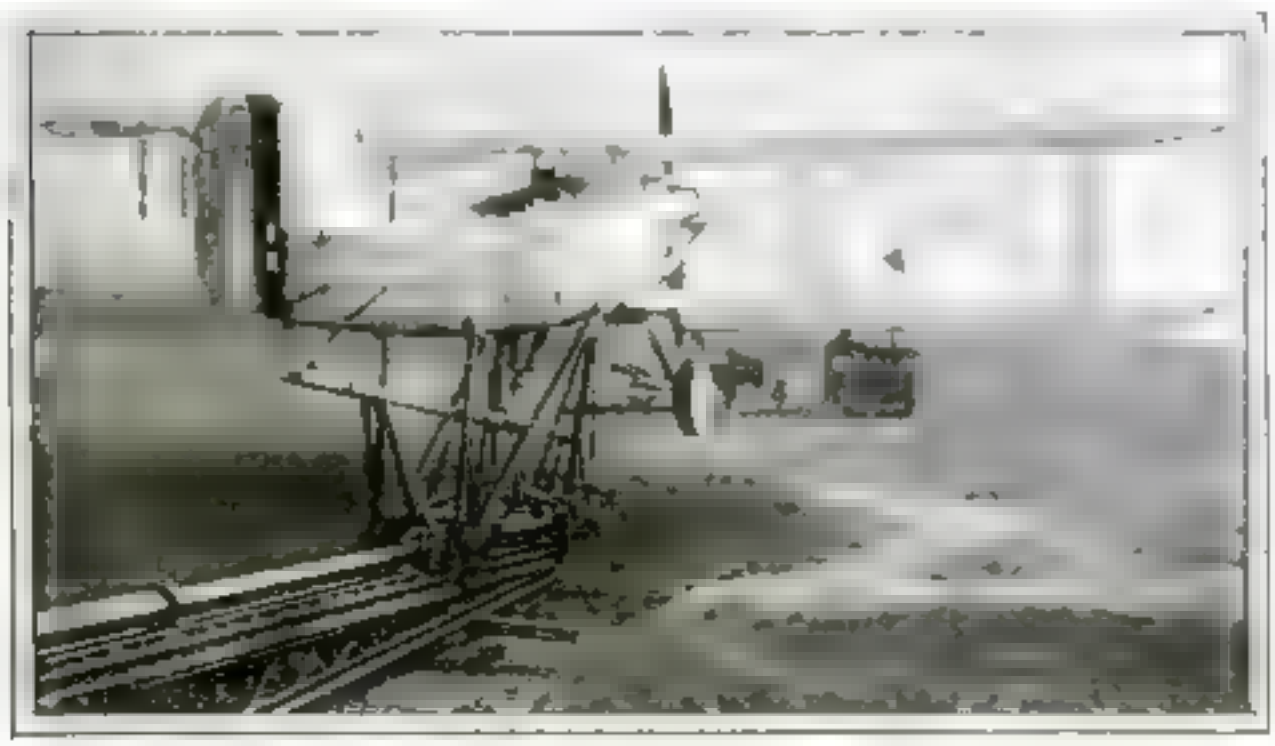
Catapults for shooting planes into the air are not new, as they have been used on war vessels for some time. Seaplanes, however, are generally used on ships.

GIANT WHEEL DESIGNED FOR MYSTERY PLANE

THE GIANT wheel seen below was built for a mystery plane now under construction in an eastern plant. Nearly five feet in diameter, it supports a load of 77,640 pounds. Its 144 spokes are laced in four rows to withstand radial [illegible]. The wheel [illegible]



This wheel, containing 144 interlaced spokes, is part of landing gear for a mystery plane.



The plane above is just being catapulted into the air by a new type launching device set up in a test pit on a British flying field. The experiments are made on land to avoid dangerous smashes.

MUFFLER QUIETS PLANE; DOESN'T CUT POWER

MISS ELDORADO JONES, of Moline, Ill., recently had her new airplane muffler tried out at Roosevelt Field, N. Y. It "chews up" motor noises by a series of small propellers spun around in an ordinary looking muffler casing by the flow of exhaust gases. After the device had proved satisfactory in ground tests and on boats, it was given a test in the air by several pilots, who pronounced it a success.

Revolutions lost by its use amount to about fifteen or twenty a minute, negligible loss since airplane motors turn up at from 1,500 to 2,300 revolutions a minute. Mufflers hitherto tried have caused a great loss of power.

Muffler for airplane motor, invented by a girl, cuts noise without greatly reducing power.

WILL TRY GASES FOR FUEL IN AIRSHIPS

A 220-FOOT flying laboratory for testing various gases as motor fuels is under construction for the United States Navy. With a capacity of 320,000 cubic feet of lifting gas, the new blimp, the *K-1*, will be the largest nonrigid dirigible ever built in America, Navy officials state. Its twin 220-horsepower engines will drive it fifty-two miles an hour and it will have a cruising range of more than 2,000 miles.

Within the new airship will be a large container to hold experimental gases which will replace gasoline as fuel. One of the first gases to be tested will be a mixture of ethane and hydrogen.

FIVE "WORLD" RECORDS OPEN TO AIRCRAFT

STRICTLY speaking, there are now only five "world's records" in aviation. To reduce the confusing number of such marks claimed for all unusual flying, the Federation Aeronautique Internationale recently decided to confine the use of the term "world record" to the following:

Duration (nonstop); distance in a closed circuit (nonstop); air line distance (nonstop) altitude; maximum speed on a three-kilometer (about 1⅞ miles) course. These records are open to airplanes, seaplanes, balloons, or dirigibles without reference to classification.

Other records will henceforth be known as "international."

Berlin to New York in Six Hours!

Mystery plane, secretly built in Berlin, expected to fly 700 miles an hour at height of 35,000 feet. Double-walled cabin with air space shuts out cold.

SCREAMING through the thin air 35,000 feet above the earth, at a speed of eleven miles a minute, a new German mystery plane now being built by the famous Junkers Company may soon cross from Berlin to New York in less than six hours. Its builders have established a rigid censorship of all news about the super plane, but some details of its construction were recently cabled to America. It is being built of duralumin and resembles ordinary aircraft streamlined beyond present-day practice and with landing gear that can be drawn up into the fuselage in flight.

If this machine succeeds in making its transatlantic flight it will mean that man's efforts to annihilate space have resulted in "making the sun stand still." Flying at eleven miles a minute in a westerly direction in the latitude of Berlin and New York, this giant aerial torpedo could keep the sun stationary over its head.

On the take-off this craft would climb to the 35,000-foot level at an angle of forty-five degrees. A new type of propeller, specially designed to work in thin air, is one of the unusual features of the machine. In order to make the cabin habitable in the extremely low temperatures of high altitudes, the fuselage has been designed like a giant thermos bottle.

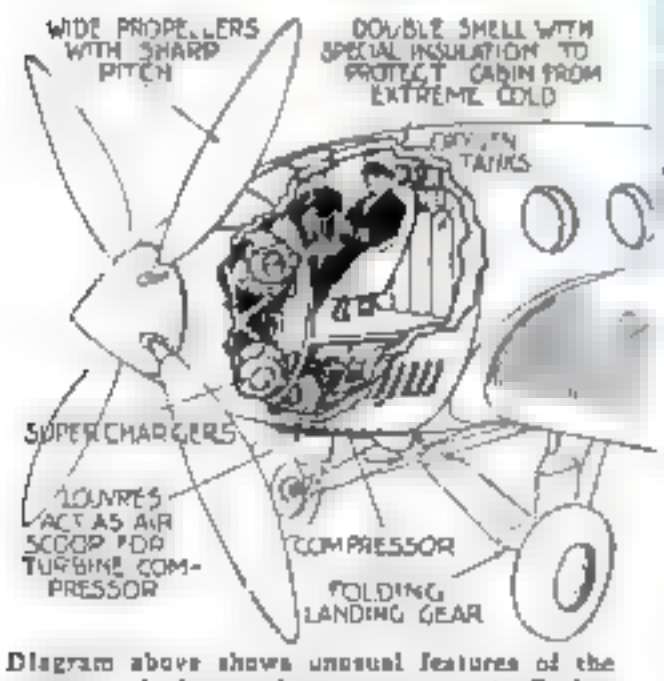


Diagram above shows unusual features of the super-speed plane under construction in Berlin. Note sharp pitched propeller and double shell cabin. At right, diagram of lines of proposed flight from Berlin to New York along air level 35,000 feet high. At top, artist's conception of the great plane in flight above Atlantic Ocean.

Diver Flies

Flyer Dives

Assen Jordanoff Tells How He Exchanged Thrills with a Navy Hero

Jordanoff, the diver descended [illegible] Chief Gunner William F. Loughman, famous Navy diver at New London. At upper right, Jordanoff is nearly ready to step into sea

I ONCE saw a cartoon showing a deep-sea diver looking up at an airplane and the airplane pilot looking down at the diver. Each was saying "Gee, it must take nerve to do that!"

How much nerve it takes to go down in a diving suit I discovered the other day when I traded sensations with Chief Gunner William F. Loughman, famous Navy diver, at New London, Conn. I gave him his first ride in an airplane and he gave me my first descent in a diving suit.

It was about ten o'clock in the morning when I sat down at the New London field. I had been flying through New England and stopped at New London to visit a friend. This man introduced me to Loughman.

"Do you know," Loughman said after we had shaken hands, "I have been diving for almost twenty years, but I've never been up in an airplane."

"You have nothing on me," I replied. "I have been flying for almost twenty years and I've never been down in a diving suit."

"Come on over to the Submarine Base," said Loughman, "and I'll take you down."

"All right," I agreed. "And I'll give you a ride in my plane."

While I warmed up the motor, Loughman slipped on a leather jacket, helmet and goggles. I helped him on with his parachute. While we walked around the plane, I explained how the different parts operated. Loughman listened, but I could see his mind was not following my lecture. Finally he broke in:

"Now, if I have to jump, how do I open this parachute?"

I explained how to pull the rip cord. "But you won't have to jump," I assured him.

Then he wanted to know what makes airplanes go into tail spins. He had read the newspaper headlines and knew all about the dangers of flying. When I helped him into the rear cockpit and showed him how to buckle the safety belt, he looked as though he wanted to kick himself for having opened the way for my suggesting the flight. But he was game. He shouted above the noise of the motor:

"NONE of this loop-the-loop stuff, mind you! I have papers in my pocket for a ten-day leave and don't want them to fall out!" I promised to keep right side up.

We taxied to the far end of the field. I swung into the wind, gave her the gun, and we were off. The ground wind was gusty and filled with bumps. The ship rocked like a catboat in a squall until we got to

Here Jordanoff is in his element as he points out to Diver Loughman the various parts of flying machine

Loughman, in the cockpit, gave final flight directions.

At left, Loughman, as he dons the parachute, doubts the wisdom of this air adventure. Above, the flight is over.

1,500 feet. Then the air smoothed out. I glanced back. Loughman was as rigid as a chair back. He was gripping the sides of the fuselage for dear life. I swung in a wide turn. He leaned to the high side as far as he could. I grinned back at him. He didn't pay any attention to me. I was having my fun now. Later, he had his.

THE next time I looked back, he was peeking over the side and had relaxed a little. We headed up the Thames River high above a mother ship with four submarines clustered at its sides, and swung over the Navy base with its new 100-foot tower filled with water in which Loughman instructs undersea sailors in the use of the "submarine lung." He reached ahead, poked me in the back, and pointed at the tower. When we landed, he said:

"Remember when I poked you and pointed out the tower? I was thinking that when I am using the 'lung' inside that tower, I am underwater and up in the air!"

"Was flying as bad as you expected?" I wanted to know.

"Well," he answered honestly, "the first minute was. I think I had my eyes shut when we took off. I know I didn't dare look down until we were way up. Then I began to enjoy it. The part I liked best of all was that up and down, roller-coaster movement when we hit bumps. It was all kinds of fun. I always thought the sensation would be like dropping in an elevator. But it wasn't at all. After I got used to the noise of the motor and decided the wings wouldn't break off, I had a grand time. Now come out to the Submarine Base and I'll start talking about something I know about."

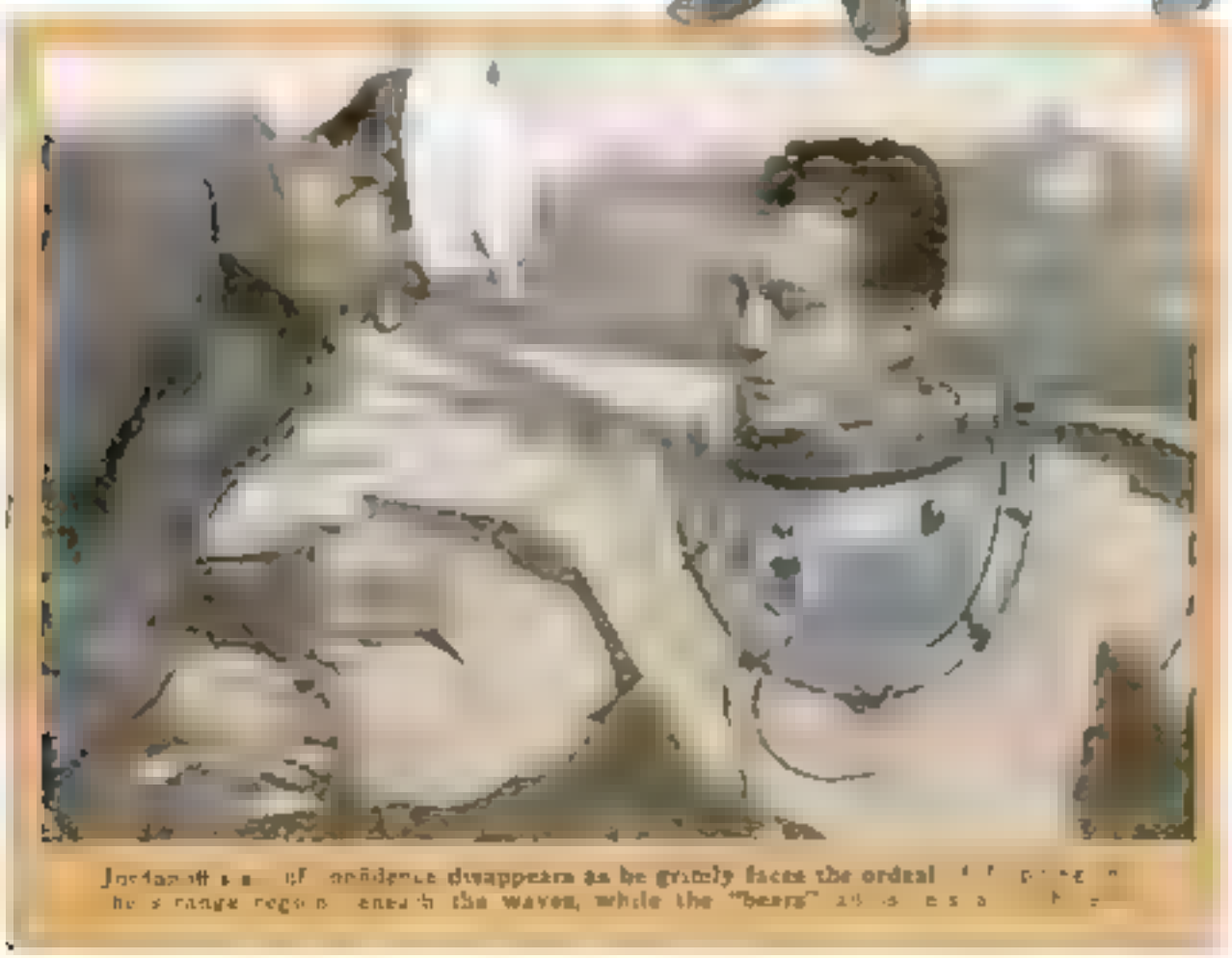
THERE are few men who know more about deep-sea diving than William Loughman. He volunteered in 1913 to undergo scientific tests to determine how the human system reacts under great pressures. He was one of the band of heroes who worked on the sunken submarine *F-4* in 1915, the *S-51* in 1925, and the *S-4* in 1927, and for his exploits under the sea he has received citations and the highest of naval honors, the Navy Cross.

Once, off Honolulu, Hawaii, he was trapped on sea bottom by a fouled lifeline for six hours and came to the surface nearly paralyzed with "the bends."

"What do you mean by 'the bends'?" I asked him.

"That is the diver's term for caisson disease. As you go down, the pressure increases about half a pound for every foot you descend. Under great pressures, gases from the air dissolve into the blood stream and flow all through the body. If you come up too quickly, the effect is the same as taking the cap off a pop bottle. The gases suddenly resume their old form and the tiny bubbles get in the veins and joints and press against the delicate nerve centers.

"Sometimes a diver with the bends will be covered with red spots like mosquito bites. Each (Continued on page 134)



Jordanoff's air of confidence disappears as he grimly faces the ordeal of [illegible] his strange regions beneath the waves, while the "bears" [illegible]

Homemade Plant Pills Grow Crop in Sand Hill

Amateur chemist makes food for vegetables and has striking success with seeds planted in Lake Michigan dunes. Got his idea from October, 1929, number of this magazine

By ROBERT E. MARTIN

Harold K. Patterson, traveling salesman of Chicago, is half hidden behind vegetable growth he forced in his lake shore garden.

Here the plants, nurtured by the pills, are in bloom, while gladioli spikes, over a yard in height, are being left to go to seed.

This tomato, after eleven weeks of growth, tipped the scales at ten and a half ounces.

Fed by Patterson's secret mixture, dwarf tomato plants grew and produced big tomatoes in less than three months in soil in which, before, he could not make grass grow.

Gladioli, zinnias, and pansy plants, fed by chemical, push their heads above sand.

TOMATO vines three and a half feet high growing in barren, yellow sand!

That was only one of the amazing results obtained last summer by Harold K. Patterson, a Chicago traveling salesman and garden enthusiast, by the use of homemade "plant pills."

About a year ago Patterson spent an evening in a Salt Lake City, Utah, hotel reading an account in the October, 1929 issue of POPULAR SCIENCE MONTHLY of experiments made by Dr. W. F. Gericke of the University of California, in stimulating plant growth by chemical "pills." He extended his trip to California, spent an afternoon with Dr. Gericke, and tried to buy some of the chemical pellets. When he learned that the "pills" are not yet on sale, he determined to make some "plant pills" of his own.

That evening he purchased half a dozen books on agricultural chemistry. He carried them with him for months, reading them in hotels and on Pullmans. Although when he began, his knowledge of chemistry ended with the labels in his medicine cabinet he familiarized himself with the names and characteristics of plant-nourishing ingredients of the soil. He began working out formulas for condensed chemical foods for his garden.

The back yard of his summer home at Long Beach, Indiana, offered an ideal place to try out his theories. It was composed of drifting yellow sand in the dunes along the shore of Lake Michigan. In an attempt to grow grass there, the year before, twenty loads of black dirt had been dumped on the sand and the effort was a total failure. If a garden grew in that waste, Patterson knew his plant pills were a success.

He began his experiment on the thirteenth of last June. First, he dug a shallow trench in the sand and placed a fifteen-foot strip of tar paper on the bottom. Then he shoveled the sand back in on the trough, "planted" his chemical mixture in it, poured water on until pools stood in the depressions at the top, and placed a second piece of tar paper over it to act as mulching. Finally, holes were cut in the mulching paper and tomato plants, lettuce seeds, gladioli bulbs, and flower seeds of various kinds were planted.

Three days later, the first shoots appeared above the sand. From then on, new things began to pop into sight every morning. In two weeks, the gladioli sprouts were six inches high, the lettuce was two inches high, and the tomato plants were twice the size they were when they were put in the ground.

But even this did not satisfy the experimenter. He wanted his garden (Continued on page 134)

At right Renato Renfro, owner-director, rehearses his dogs for a big welcome scene. Patience and constant repetition are necessary to get them to respond to gestures and hamburger when the camera begins to click.

Inside this treadmill cage a police dog is taught to chase a man and never catch him.

Inside Story of How Animals Are Filmed

Secret Tricks of Picture World Used to Put Dumb Actors into Talkies Disclosed in This Article

By ANDREW R. BOONE

ON A tiny platform at the top of a twenty-five-foot ladder sat a chattering monkey. In rehearsal, a property man had led it up there and tried to coax the creature to jump into the water below. The monkey refused flatly to move, however, and finally the scene was faked.

The dog that was expected to follow the monkey squatted on its hind legs and refused to budge. At last one of the assistants pushed it over the edge. When it crawled out of the water, the dog voluntarily climbed the ladder and again leaped into the tank.

Many strange stories are told of animal direction on the motion picture lots; odd anecdotes of their adaptability to new surroundings, of broken sequences when an animal or a bird interrupts a tender drawing-room scene.

Today the use of animals in pictures, except in large out-of-door scenes, is confined largely to those capable of being directed by motions. So highly trained have some animals become, especially dogs, that one trainer guides his pets with signs printed on cards.

As a rule, one owner-director told me, only dogs will follow sign directions. Before sound crowded many animal actors from the casts, the studios used numbers of horses, cows, camels, and elephants. The larger animals were guided by oral commands. As a result today, in pictures where extraneous sounds ruin certain scenes, such animals cannot be used.

However animal sounds are still sure-fire laugh-getters and in outdoor pictures nearly anything in the way of noise goes. No matter whether a pig squeals or a duck quacks, the sound gets an immediate audience reaction.

Out of range of the camera, the dog's trainer makes motions to guide its attitude of prayer

THE talkies have proved a great boon for dogs, which are being used singly and in large numbers. In "Anybody's War," a comedy featuring the black-faced Moran and Mack, seventy-eight dogs appeared in one scene. Here Mack, who before the war had been a dog catcher with a heart so kind he could not execute any of his canine charges, returned to his home town in uniform to find only a lone dog on the station platform to greet him. After a moment's "conversation" with his dumb pal, Mack was astonished to see the other seventy-seven racing to greet him.

Not joy over the cake, but the trainer's hand makes the elephant curl its trunk

than animal "prima donnas" of breeding.

In these "barkies" sometimes as many as six directors put the dogs through their paces during the more intricate scenes. Noises are not important because the picture is made on silent film, and human sounds inserted later. Jules White and Zion Myers, the directors, had long experience with animals before attempting these difficult pictures.

The directors have developed lures to entice proper action from the dogs. If the script calls for Buster, the hero, and Oscar, the leading lady, to engage in conversation, a director stands off stage and waves a "lure"; the dogs look in his direction; he points at the one whose attention he wants; then opens his hand, say, four times. The dog imitates the hand motion with his mouth. Thus, he may say, "I love you, dear." Later those words are "inserted" by a human voice when sound is added to the film.

In directing dogs, White and Myers have found they have to deal not so much with temperament as with unknown dog elements. Sometimes, for no apparent reason a dog will leap through a window or crawl under a table during a scene. The camera stops and the entire scene action is redone. The leading parts are given to veteran dogs of the screen, and they seldom miscue. Each one reacts to a different direction or lure, and the vets will walk, talk, close doors, or sit pensively at a table until a new command is given. To get attention, the directors use rattles, face masks with whiskers, whistles, handkerchiefs, Halloween noise makers, rubber weiners, tidbits of meat, and bread.

DIRECTION of the dogs appearing in the "all barkies" begins long before they face the camera. The trainer keeps them together on a ranch near Los Angeles. There they learn to play in groups without fighting. In five comedies, White and Myers have had only one fight, and that was so good Myers signaled the camera man to continue shooting. Two teams of mongrels were lined up in football formation. Suddenly a "Spits University" tackle jumped an "Attitude College" defender and helmets and jerseys disappeared when sharp teeth disrobed their wearers.

Use of dogs in large numbers with real coordinated group action is a new development. At the outset, the dogs are taught to know their own names and to answer to those calls only. They are drilled so strenuously that five or six principals can be run through complicated action with fairly good results.

For these actors a special stage has been provided, with a private wardrobe department containing hats, uniforms, dresses, and other costumes they will need. Sets and properties are built small in scale, so that the dogs in the film appear as large as humans.

At the Hal Roach studio, a mile down Washington Boulevard in Culver City, Pete, the Bulldog, whose black-ringed eye in the "Our Gang" comedies has delighted children since he was three months old, acts every month.

Pete is a cross between a bull terrier and an English bull. He made his first appearance nine years ago. During these years "on the lot," Pete has become so thoroughly accustomed to the young-

Continued on page 141

Two directors are necessary to keep these dogs through a sentimental scene. Each animal is guided by the man who faces it and who uses voice and hands to do it

In oval, the parrot attacks the man when owner snaps fingers. Above, the camel mimics trainer and turns up its nose.

How was this accomplished? The dogs were not required in this scene to follow any intricate action. They had only to race up the street to the feet of their benefactor and express with their tails and bodies their pleasure at his safe return. At the outset, they had been established in several pens at the end of the street leading to the station. The action started with Mack descending from the train steps.

Rennie Renfro, owner and director of the dog actors, stood behind the camera. At the proper moment Renfro whistled. Attendants opened the most distant pen and a few of Renfro's experienced dogs bounded down the street straight for the camera, heading for the quantities of hamburger that had been sprinkled out of sight on the steps below.

As the first group of dogs passed an intersection, other cages were opened and there followed an outpouring of mongrels intent on reaching the hamburger. Renfro's whistle, which followed a sentence spoken by Mack, was cut from the film.

In one of the most ambitious undertakings, one studio is making a series of all-dog comedies. The directors there have found that half-breeds and veterans of the back alleys make the most successful picture dogs, because they are not high strung and can get along better in groups

Beads Tame Last Cannibal Tribe

Women Force Men to Trade for Trinkets and Seri Killing Lust Dies Out

By
ROBERTO THOMPSON
Mexican Government Liaison Agent to the Seri

The bow of Seri Indians is made from palo fierro stock. Above, typical [illegible]

Belle of the Seri tribe wearing her coveted beads and with face symbolically painted.

WITH the aid of colored glass beads, thread and [illegible] More than fifty Americans, Spaniards, Mexicans and other whites have invaded their country in the last twenty years and all have disappeared. How many others have been killed and eaten, leaving no record, is unknown.

These cannibals are the Seri Indians of Tiburon Island in the Gulf of California, less than 200 miles south of the boundary of the United States. Their origin is unknown, though they speak a dialect of the Opata, from which they take their name of Seri (spry or active), but call themselves Konkaak, with a click somewhat like that of the Kaffirs, between the first and second consonants.

THEIR island of Tiburon (Shark) is barren, and for a one hundred miles inland in Mexico, the country is desert with almost no water. This, with the fierce bravery of the Seri and their long and powerful bows, has preserved their racial integrity.

But the automobile, able to cross the desert without water; the motorboat, able to ride the rough and stormy waters surrounding Tiburon Island; the telephone, with which remote ranches in Seriland are able to communicate with the armed forces of Sonora state government, and, more powerful than all, the brilliantly-colored glass beads—that we are sending to the Seri women—are making peaceful conquest of the Seri. The beads even bring the warriors in to my ranches on the mainland to trade skins and venison for these baubles.

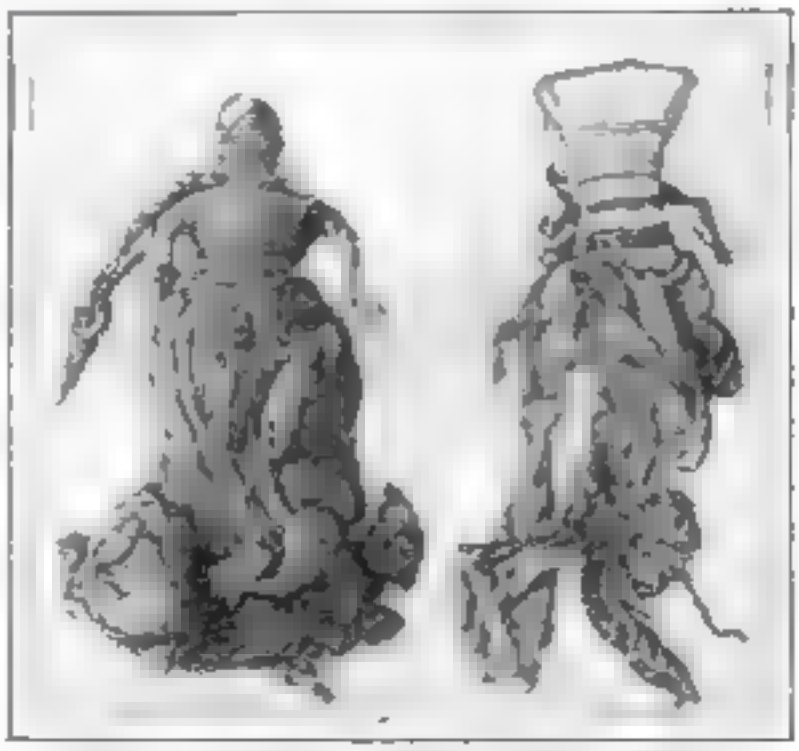
GOVERNED by the women up to about thirty years ago, when the men took a hand in ruling themselves, the Seri women now demonstrate their power by demanding beads and more beads. In order to get the beads, it is necessary to have peace with the whites, and the savage warriors are obeying the women. Twenty years ago, when I was a boy on these ranches, scarcely a week passed in which [illegible] cowboys did not have a pitched battle with a raiding band of 50 to 200 Seri.

Not only did the Seri eat enemies captured or killed in battle, but they hung their own dead, wrapped in deerskins, in trees to be eaten in case of a shortage of [illegible] food. Since the tribe has decreased from about 7,000 some twenty years ago to not more than 2,000, with [illegible] more plentiful and cannibalism is disappearing.

The Seri have fire but eat almost all their food, animal and vegetable, raw, storing or preserving nothing but hunting animals and gathering fruits and roots as hunger impels them. They use stones as hammers and shells as knives and cups, but do not shape any of them. They do not have knives either of stone, wood, or metal, except those they steal from the Mexican settlements, or which the Mexican government trades or gives them.

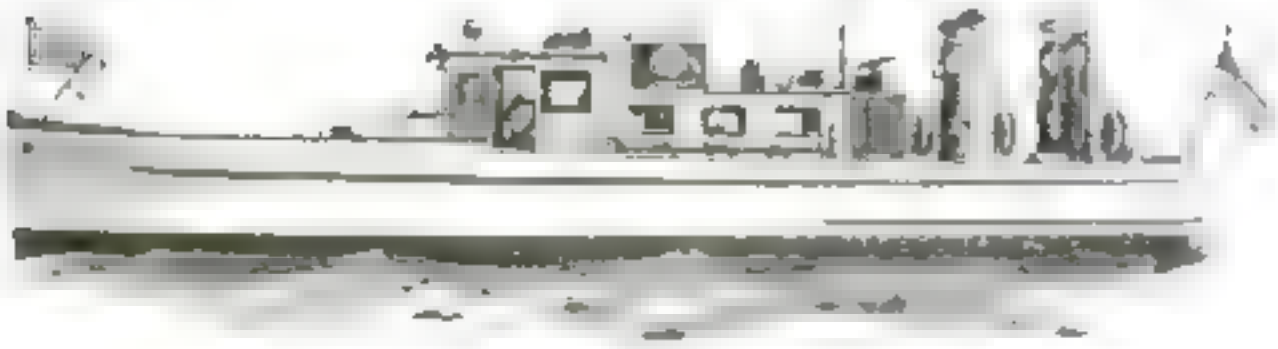
They use bone and wood for arrow-points, and their arrows are three to five feet long, made of reeds. The bows, five to six feet in length, depending on the height of the bowman, have a killing range of seventy-five to eighty yards and a flight range of 300 yards. They are the largest and most pow-

(Continued on page 137)



Pictures by Courtesy of Bureau of American Ethnology, Smithsonian Institution.
Fetishes of Seri Indian women, now made of cloth.

BOAT SERVES GAS TO HARBOR CRAFT



THIS novel fifty-four-foot craft supplies yachts, seaplanes, and motorboats with fuel and lubricating oil at Chicago. The marine service station carries a total of 5,000 gallons of fuel, including high-compression and ordinary gasoline and Diesel oil in its tanks.

Fuel and lubricants can be delivered to boats thirty-five feet away by pumping them through hoses in which there are no couplings. This gas station is designed as a substitute for the nonfireproof wooden tank barges generally used throughout United States waterways.

TROUT JUMPS THROUGH HOOP TO GET FOOD

After doing his trick this trout [illegible] edge for his food

AN UNUSUAL fish story comes from Port Townsend Wash with photographs to back it up. A resident of that city, who had placed a trout in a public fountain, trained it to jump through a hoop when it was hungry. Then it would flop up on the edge of the pool for its reward, as shown in the photograph above

When the trout was first placed in the fountain it was only three inches long, but it grew rapidly under the daily care of its keeper. Soon it would leap out of the water for a piece of liver suspended within a hoop held close to the surface. Eventually the fish learned to jump through the bare hoop, and then swim to the edge of the fountain for food.

Stories of trained fish that flocked to be fed when the shadow of their trainer fell on the water and of those that came in response to vibration set up in the pool are common but this is one of the first to be sustained with photographs of the fish doing their tricks.

MAY CHANGE HEIGHT OF KITCHEN APPLIANCES

TAILOR-MADE kitchens, fitted to the housewife's stature, will be a feature of model homes soon, if plans made at the Women's Art and Industries exhibition recently are accepted by manufacturers of kitchen appliances. Dr Lillian G. Gilbreth measured 5,000 women, the measurements being taken to show height from elbows to floor, height of the worker, and arm reach. These will be used in building sinks, stoves, cabinets, worktables, and other kitchen appliances and furniture.

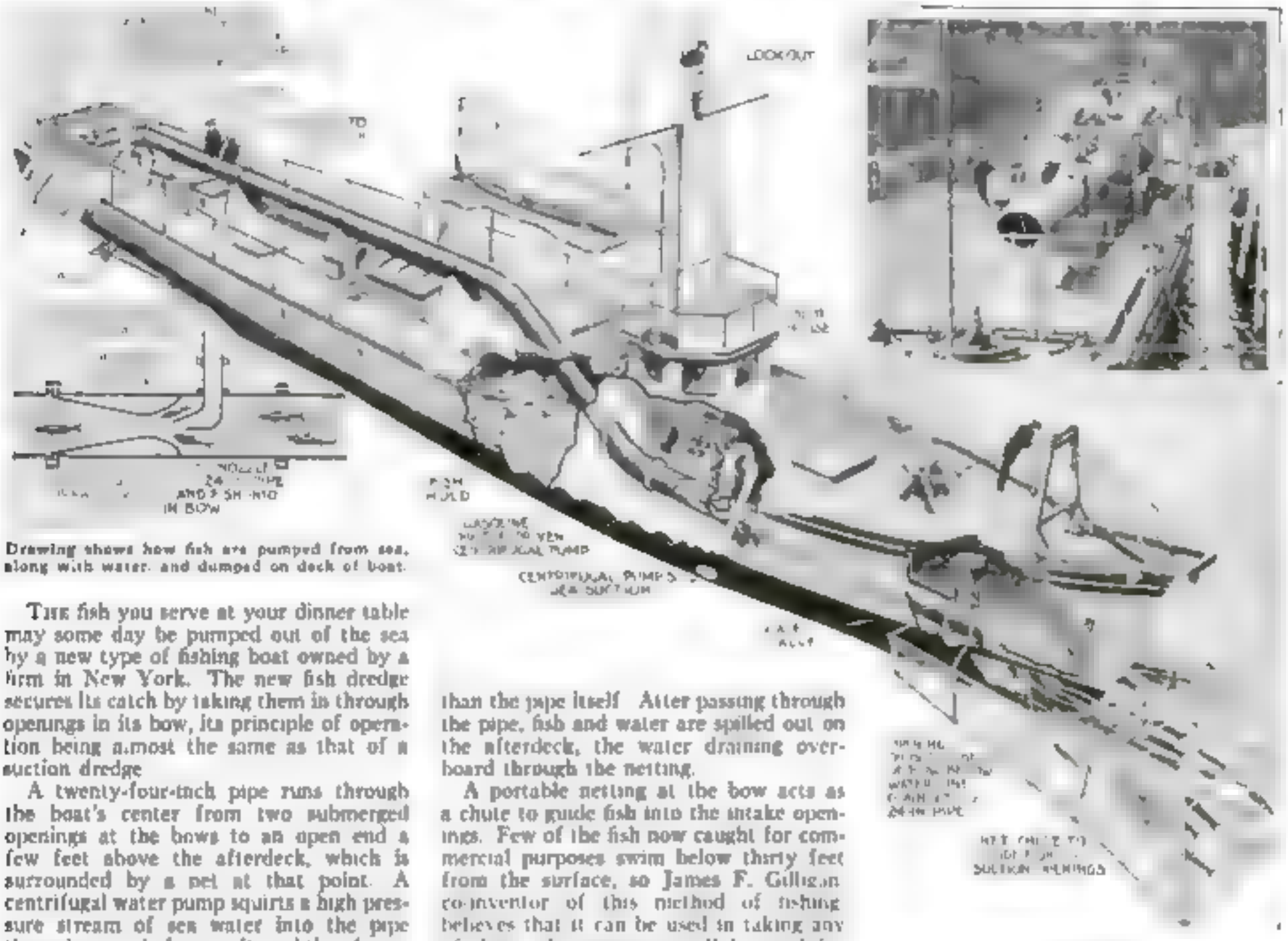
ADJUSTABLE PLATFORMS HELP MOVIE SHOTS

MOTION pictures from unusual angles may now be taken easily by an apparatus recently perfected in Hollywood, Calif. Microphones, cameras, and directors mounted on platforms can be raised, lowered, or swung from side to side in a few seconds by its hydraulic lift, taking shots from any desired angle.

ANIMALS IN PARIS GET EXPERT SURGICAL AID

PARISIAN animals, pets and those that live in the zoo, now receive expert medical attention at a completely-equipped veterinary hospital. The physician in attendance at this institution has performed many delicate operations on animals at the zoo. Among the patients he has treated are a pelican, a parrakeet, a small African monkey, and a cormorant.

New Fishing Boat Sucks in Catch through Huge Pipes



Drawing shows how fish are pumped from sea, along with water, and dumped on deck of boat.

THE fish you serve at your dinner table may some day be pumped out of the sea by a new type of fishing boat owned by a firm in New York. The new fish dredge secures its catch by taking them in through openings in its bow, its principle of operation being almost the same as that of a suction dredge

A twenty-four-inch pipe runs through the boat's center from two submerged openings at the bows to an open end a few feet above the afterdeck, which is surrounded by a net at that point. A centrifugal water pump squirts a high pressure stream of sea water into the pipe through a nozzle facing aft, and thus forces a large volume of water to flow in at the bow. Fish can easily pass around the nozzle, as it is much smaller in diameter than the pipe itself. After passing through the pipe, fish and water are spilled out on the afterdeck, the water draining overboard through the netting.

A portable netting at the bow acts as a chute to guide fish into the intake openings. Few of the fish now caught for commercial purposes swim below thirty feet from the surface, so James F. Gilligan co-inventor of this method of fishing believes that it can be used in taking any of them. At present it will be used for catching menhaden, or "mossbunkers," which are used for fertilizer and oil. It is planned later to use it for food fish

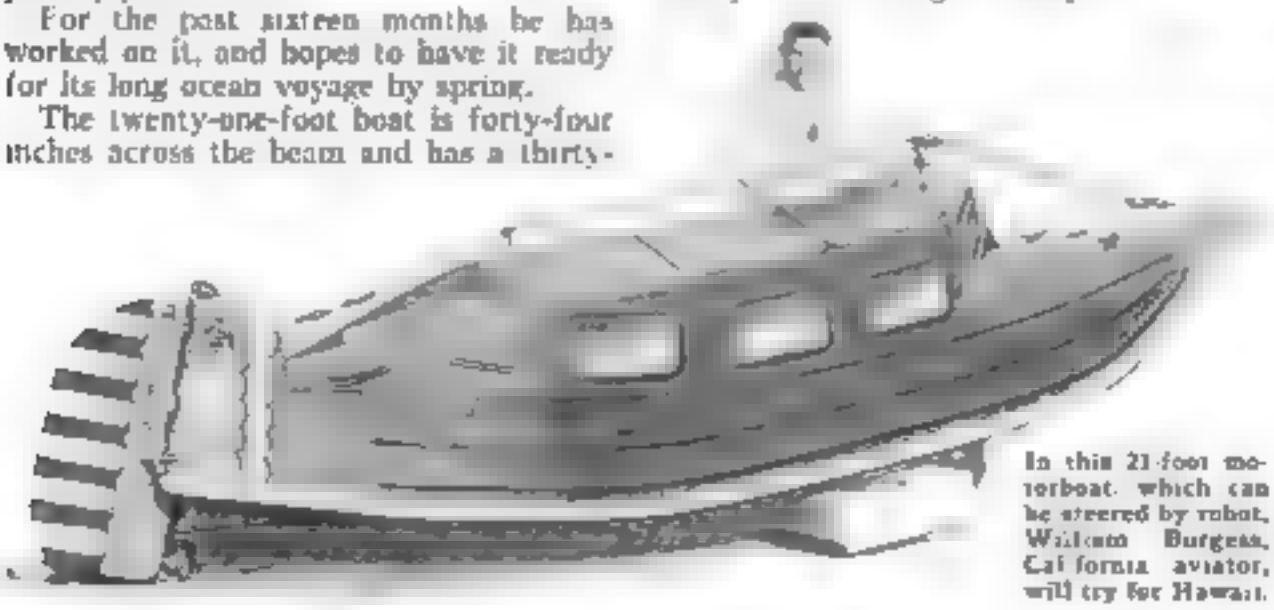
ROBOT AT HELM ON OCEAN VOYAGE

CROSSING the Pacific alone from California to Honolulu at forty miles an hour with a mechanical pilot taking the helm while the owner sleeps, is the object for which the unusual craft shown below is intended. William Burgess, California aviator, who designed and built the boat, estimates that it will take him three and one half days to make the voyage in this little boat, which is built entirely of airplane plywood

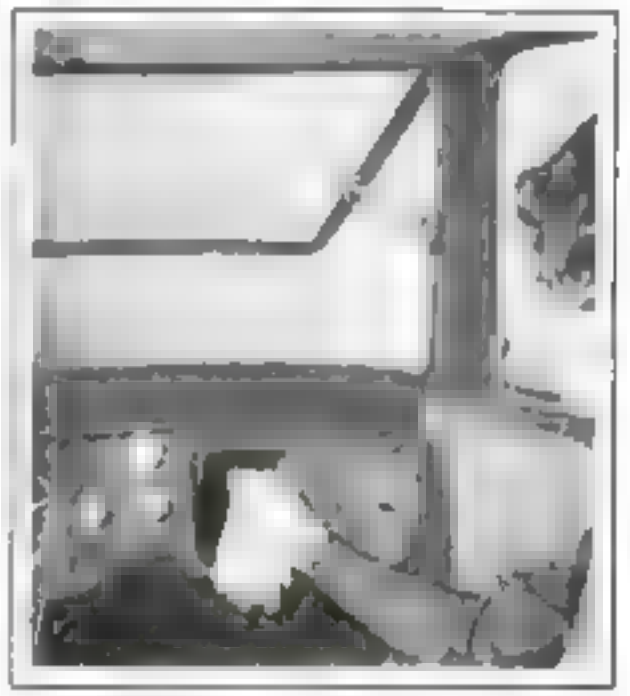
For the past sixteen months he has worked on it, and hopes to have it ready for its long ocean voyage by spring.

The twenty-one-foot boat is forty-four inches across the beam and has a thirty-six-inch draft. The rudder, as can be seen, is similar to that of an airplane, and is so attached that two thirds of it stands out of water

The total distance from Santa Monica Bay to Honolulu is 2,227 miles, and if Burgess maintains his estimated speed of forty miles an hour he would make the trip in less than sixty hours. Running time, however, will be reduced during his rest periods during the trip.



In this 21-foot motorboat which can be steered by robot, William Burgess, California aviator, will try for Hawaii.

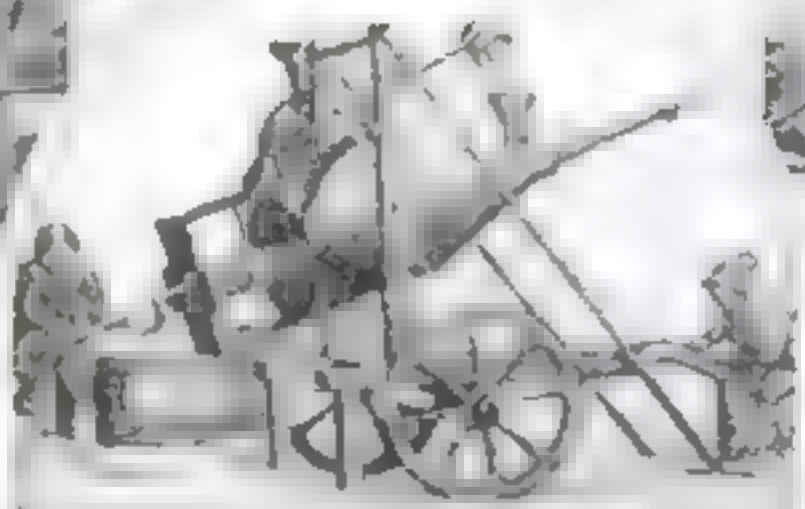


GLOVE COMPARTMENTS SET IN DASHBOARD

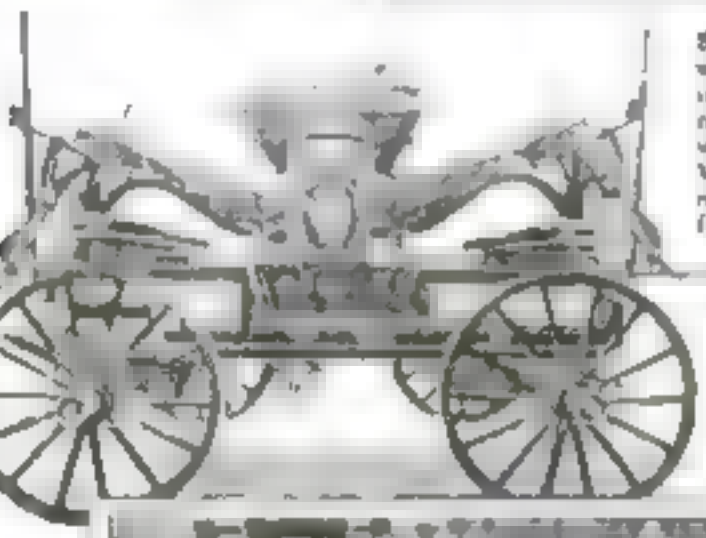
A GLOVE compartment at each end of the instrument board is an unusual refinement of a luxurious new motor car. In these compartments driving gloves can be kept so that they are always handy and their loss, when not in use, is unlikely. The compartments also may be used to hold any small personal articles, such as cigarettes or vanity case, while driving. A carefully fitting door does not mar the appearance of the dashboard.

Fire Fighting Machines of *Yesterday and Now*

Hand squirts similar to ones used by Germans fought English fires in 1500.



This crude apparatus marks a big advance in fire fighting. It was one of the early hand pumps and was carried to the fire and filled with buckets. Note detachable handles

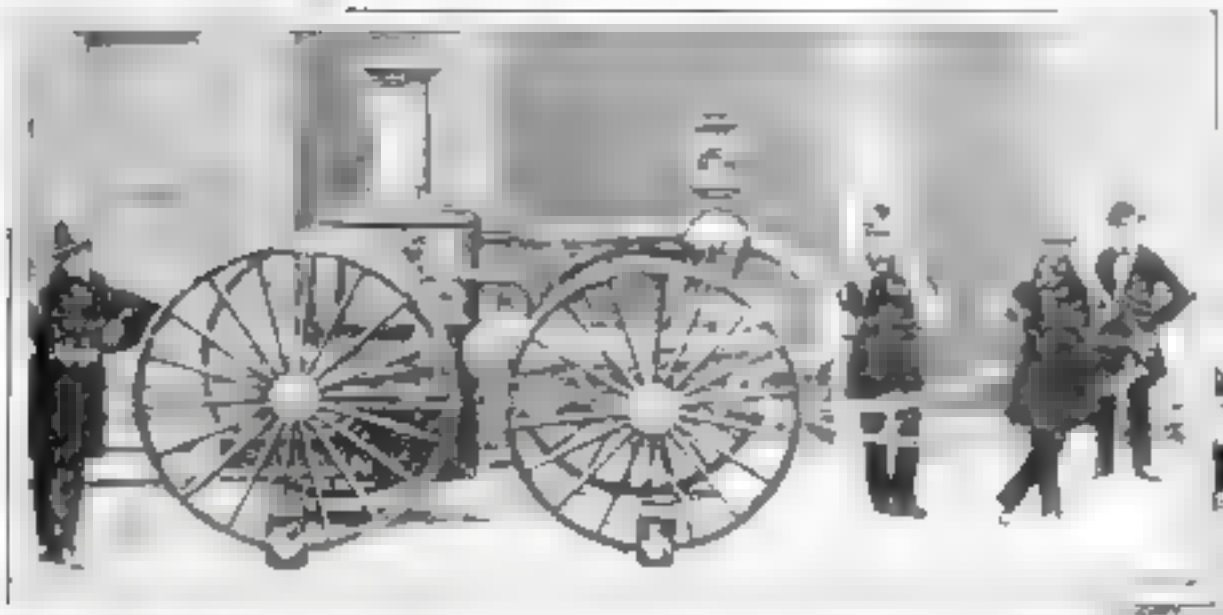


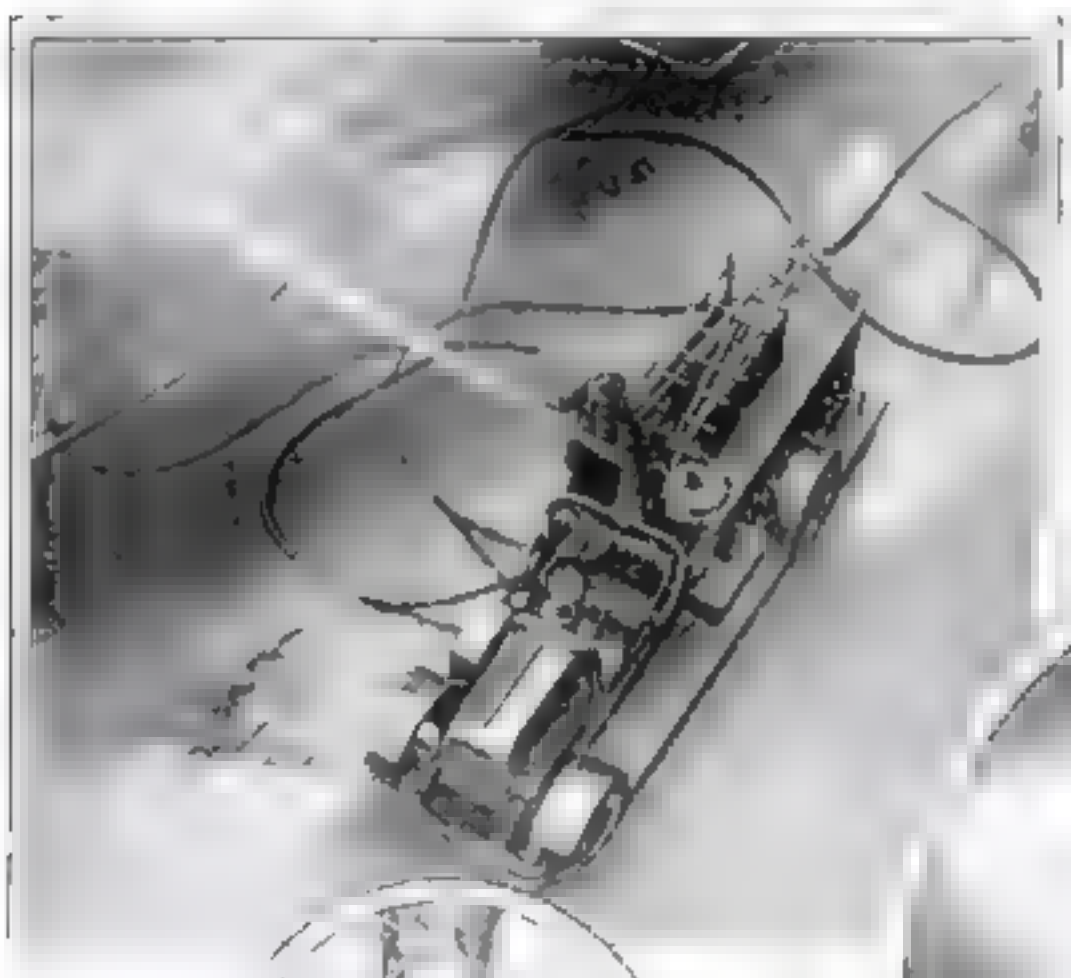
Some mechanical genius, weary of the hand squirt, invented this giant syringe mounted on wheels and worked by a hand crank. Water poured into the funnel from buckets was forced from nozzle by the plunger

Here is the hand pump put on wheels so that it could reach the fire in less time. American fire engines, coming from England were of this type. The one pictured above was used in a Long Island town in 1820.

At top Philadelphia's first fire engine, with tank carried on circus wagon. In center an early hose reel company with its men and uniforms, all set for action. Above, the embattled volunteer firemen, with rivalry keen between engine and hose reel crews race it out to see which one gets to the fire first. Street conflicts were not unusual as the teams fought for supremacy indifferent to the fact that the fire, meanwhile, burned merrily

Alexandria, Va., had this elaborate fire engine, named the *Friendship*. So designed that two crews could work at the pump handles at once. It threw a stream of water 110 feet.





LOOKS LIKE A MONSTER BUT IS KITE-BALLOON

RESEMBLING some strange monster, this odd-looking balloon was used in recent maneuvers of the British army at Wiltshire, England. It is a captive, or "kite," balloon so called from the fact that, while it is allowed to rise, it is never free remaining moored to the ground at all times.

Such balloons are used by military men for observing the effect of artillery fire on distant points that cannot be seen from gun positions on the ground. They were first brought into use in actual warfare during the American Civil War, and were then of the spherical type Count Zeppelin, inventor of the rigid dirigible, obtained his first ballooning experience with them during that war in this country.

The bulges that give the balloon its odd look are stabilizers to keep the craft on an even keel in the air.

England has just developed and recently tested this remarkable appearing kite balloon which is also good for observation purposes during an artillery attack.

FINDS CURATIVE RAYS IN HOUSEHOLD LAMP

NEARLY every child has placed a lighted flashlight in his mouth, and watched the glow shine through his cheek. The other day, a scientist did the same thing in order to learn new facts about lamps. As a result he was able to tell medical men that an ordinary household electric bulb gives off invisible, curative rays that penetrate human flesh.

Special medical lamps are designed to treat certain cases of rheumatism, sinus infections, and other ailments benefited by heat, by a method popularly known as "baking."

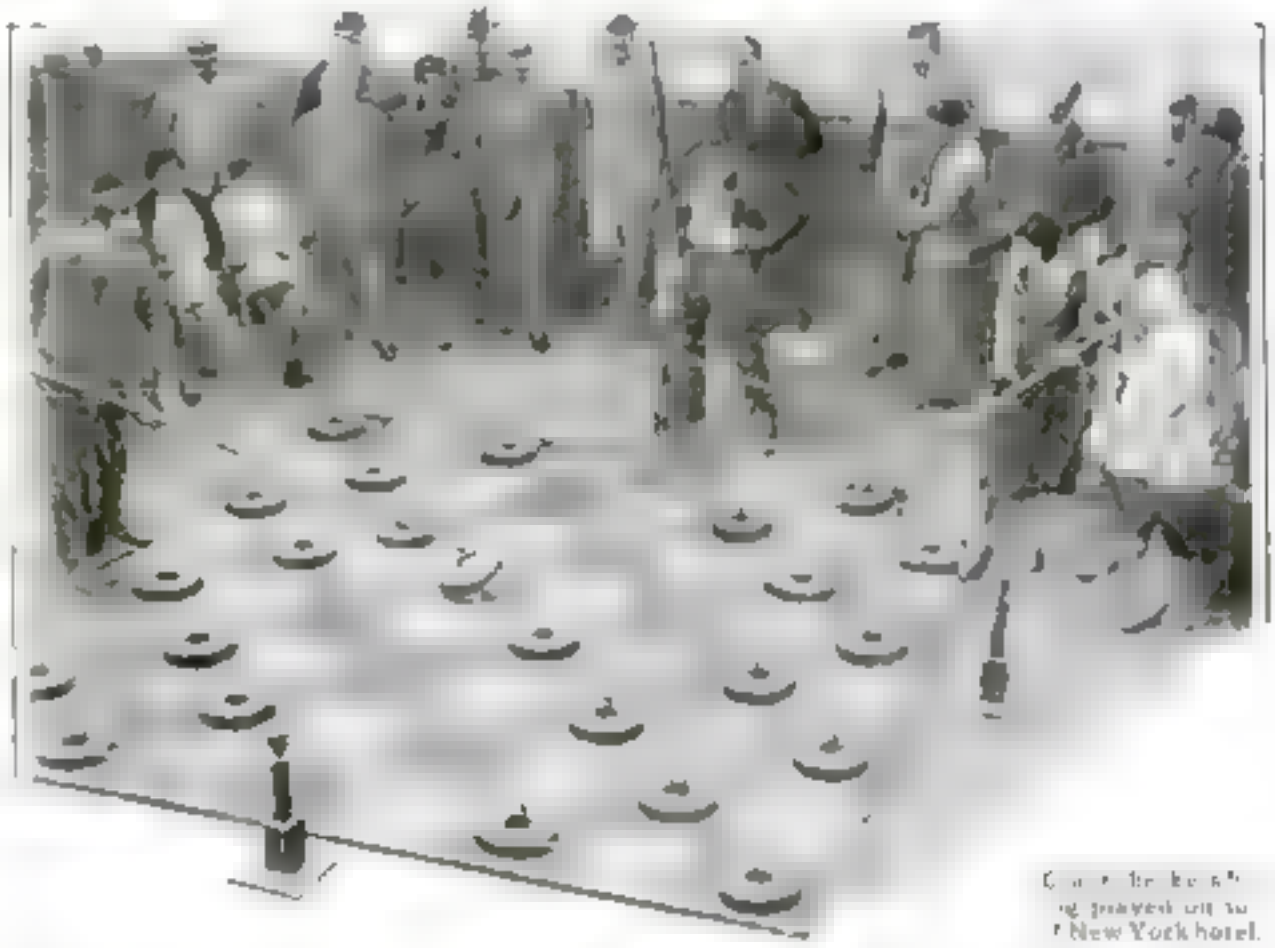
Dr. C. Hawley Cartwright, a research fellow at the California Institute of Technology, undertook to find out, with himself as the subject of his experiments, what kind of rays best penetrate human flesh.

For an experimental area, Cartwright chose his own cheek. He allowed light to pass through it first from a small incandescent bulb in his mouth, and then with the light of a 500-watt lamp reflected in a mirror held in his teeth. Meanwhile he observed the strength of the different types of rays after they had emerged with a sensitive thermocouple, an instrument he had designed to measure the heat from distant stars.

"Long-wave" rays, the invisible variety known as "infra-red" or "black light," penetrated well. One of the shorter members of the infra-red group came through best.

Dr. Cartwright found that a lamp for heat treatment could use an ordinary lamp bulb. It should be covered, however, with a glass filter capable of removing visible rays.

GIANT CHECKERS NEW OUTDOOR GAME

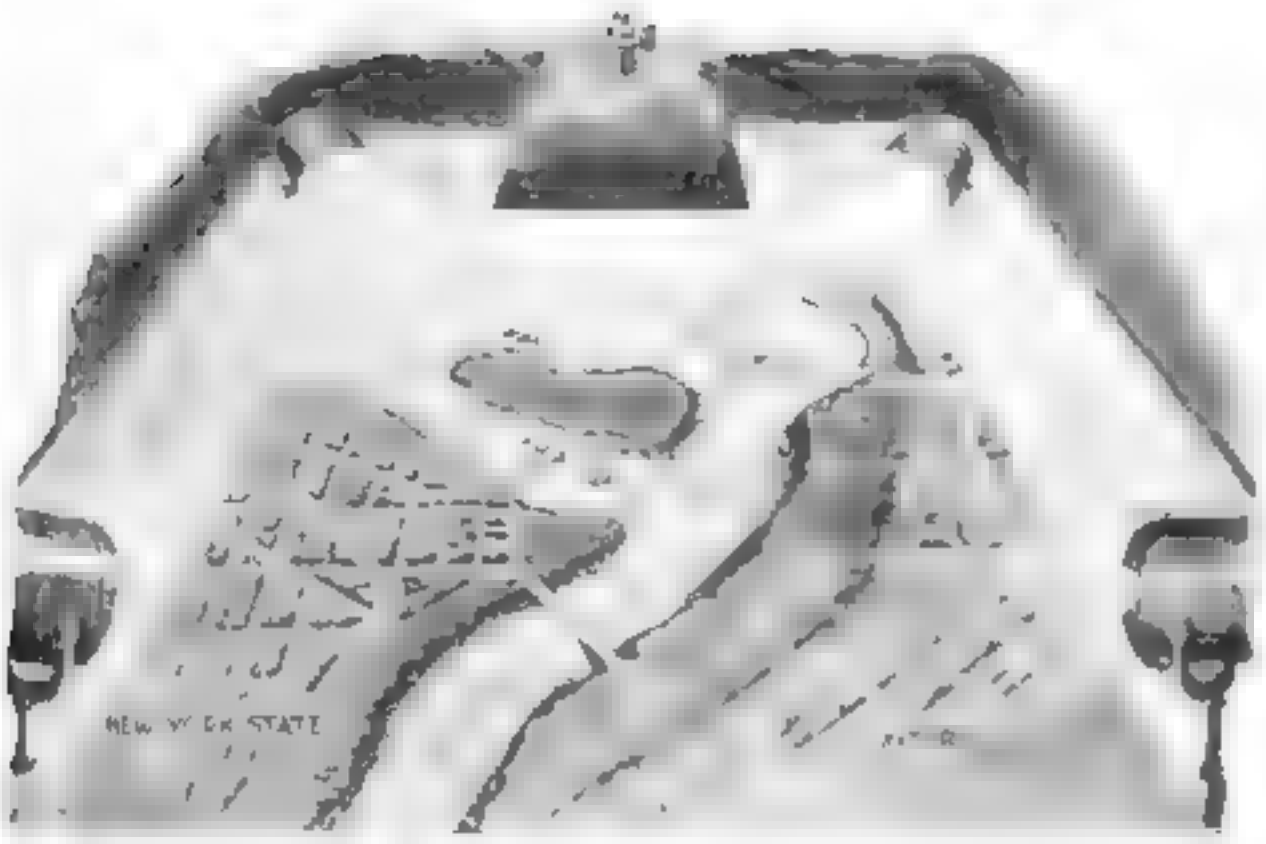


Giant checkers being played on the roof of a New York hotel.

GIANT checkers, recently demonstrated in New York City, may rival midget golf in popularity. The game is played on a board that measures twelve feet by twelve feet, each space being a foot square. The men, about eight or ten inches in diameter and weighing several pounds, are fitted with a loop on their tops. Each player is given a ten-foot pole with a hook on its end with which to move the pieces over the board.

Rules for the big game are the same as those used for the indoor game played with small equipment. The large game furnishes the players with exercise, as they have to move about, stoop, and lift the men to new positions. The picture shows the first game being played on the roof of a New York hotel before interested spectators.

The new game may be played indoors or outdoors, wherever and whenever space or weather permit. The board is made in hinged sections so that it may be folded up for transportation. Deck chairs form part of the equipment for this game so that players sit down when pondering their next move.



AMERICA'S LAMPS EQUAL TINY SUN

How well men rival Nature at producing light is shown in a recent comparison by Dr. Samuel G. Hibben, of the Westinghouse Lamp Company.

If all the electric lamps in use throughout the United States could be brought together, he declares, they would illuminate an area of about one square mile as brightly as sunshine. This area, for example, might take in Niagara Falls and a small amount of neighboring land, including the International Bridge, as shown in the accompanying sketch.

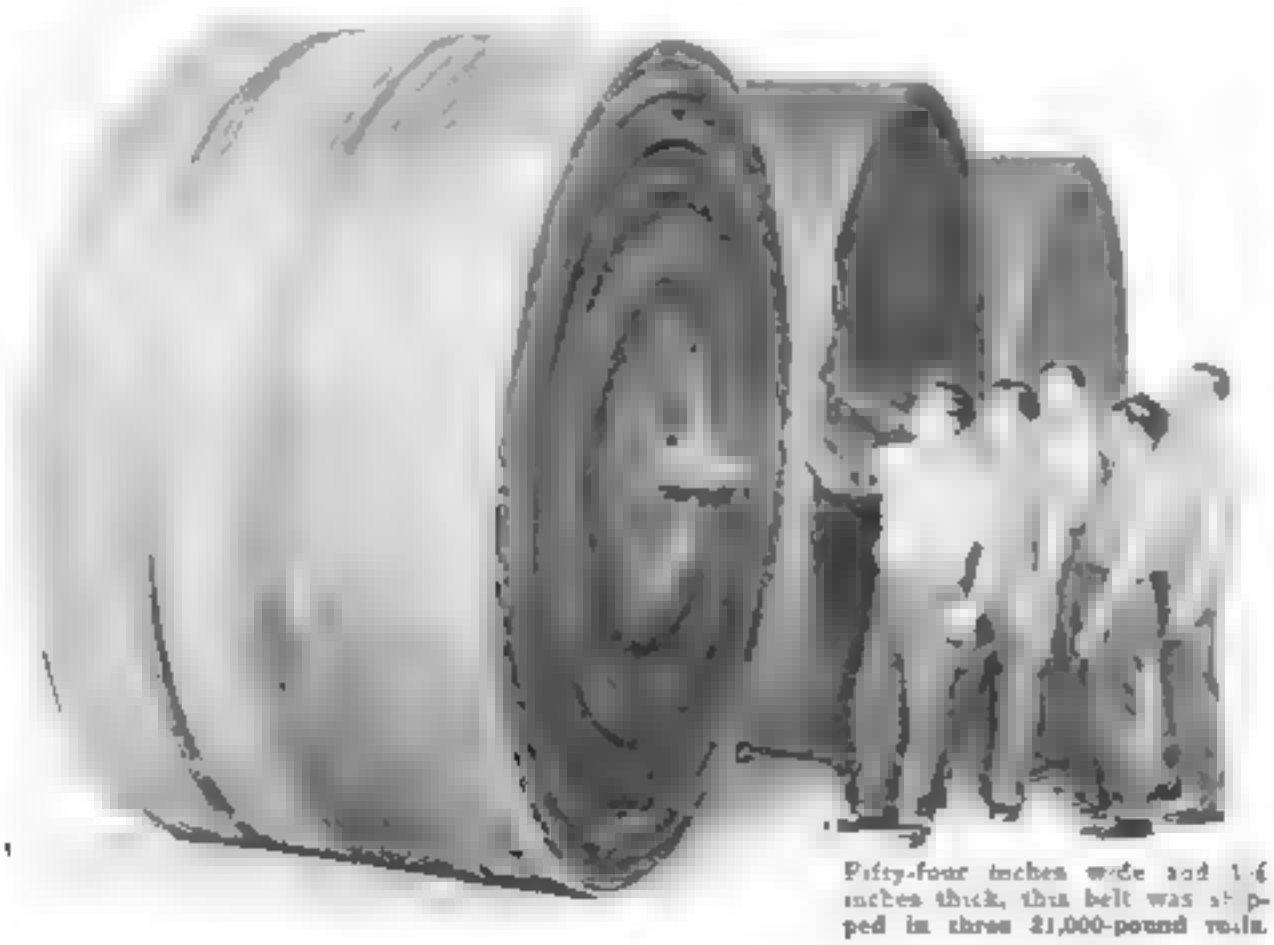
Taking the moon's rays as a standard, man does better by comparison. The same lamps could illuminate 400,000 square miles, an area including all of New England, the Middle Atlantic States, and several South Atlantic and Central States.

To light the entire earth with the brilliance of sunlight, it would be necessary to use about twelve and a half lamps over each square foot of surface. But at present with lamps only about fifty percent efficient, actually twice as many bulbs as stated above would be needed.

WORLD'S BIGGEST BELT WEIGHS 63,000 POUNDS

A CONVEYOR belt, the largest of its kind ever made, was recently shipped to the plant of a Michigan limestone and chemical company. It is fifty-four inches wide and one and three quarters of an inch thick. Because of its great size it was shipped in three sections, each of which weighed 21,000 pounds, making a total weight about equal to the capacity of the average freight car.

This great belt will be used on a conveyor that is 700 feet long. It will handle 1,950 tons of limestone an hour. The picture shows the belt sections being prepared for shipment.



Fifty-four inches wide and 1.6 inches thick, this belt was shipped in three 21,000-pound rolls.

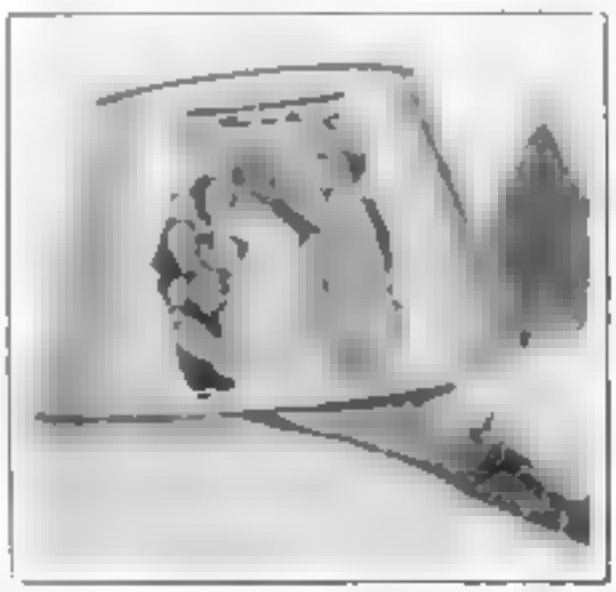
ADDS PORTABLE SAW TO HIS 2,000 INVENTIONS

THE man who probably has made more inventions than anyone else in the world, Ethan I. Dodds, Central Valley, N. Y., has a new one to his credit. This time it is a new type of portable electric saw, with a narrow blade that shuttles back and forth in a one-inch stroke. Dodds expects the saw to be a boon to carpenters, since it will cut four-inch lumber, weighs

Ethan I. Dodds, Central Valley, N. Y., demonstrates the latest of his 2,000 inventions.

only fourteen pounds, and can be carried in a tool kit. Other models are adapted to tasks of differing size.

At fifty-one, Dodds has more than 2,000 patents, a greater number even than those of Edison. His inventions fill eight large volumes on the shelves of the Patent Office at Washington, D. C.



THIS CLIP MAKES SHADE FIT ANY TABLE LAMP

STANDARD shades fitted with a screw thread for bridge lamps will not fit over the bulb of a standard table lamp, as many a householder has discovered to his sorrow. Consequently, an eastern inventor devised this ingenious adapter, which converts a threaded lamp shade into one of the clip type.

Inexpensive and inconspicuous, it doubles the usefulness of a favorite shade. The adapter is attached in a moment to any ten- or twelve-inch shade.

MACHINE DIGS TRENCH, LAYS CABLE

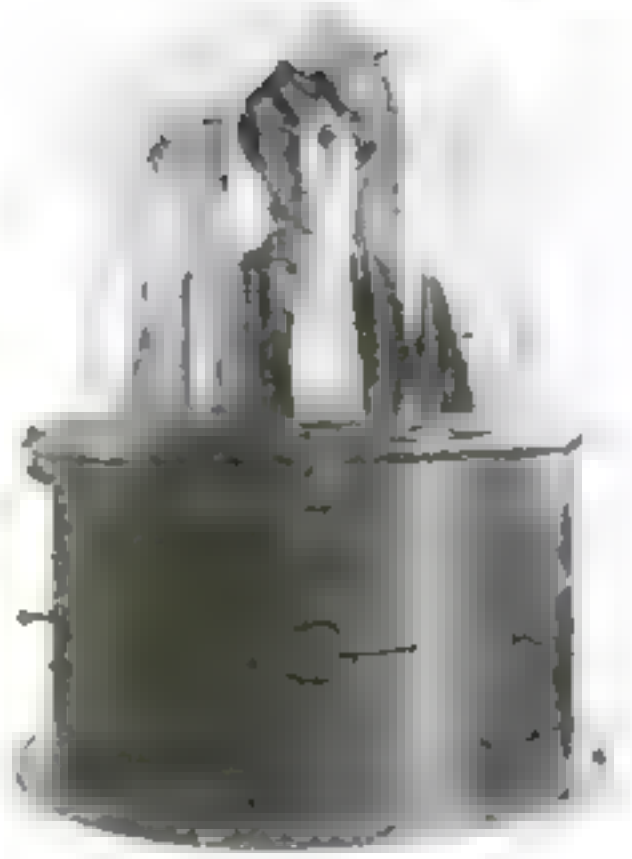
A trench is dug and the cable laid and covered in one operation by this device

A STRANGE-LOOKING train of machinery was used by a telephone company in [illegible] the other day for speeding up its cable-laying operations by excavating a trench and laying cable in it at one [illegible] tion. A truck towed a framework [illegible] carried a large cable reel at one [illegible] This in turn drew an excavator [illegible]

As the apparatus moved [illegible] excavator dug a furrow in the earth and the cable was paid out from the reel through a tube by the forward motion of the machinery. No manual attention is required in laying the cable beyond guiding the apparatus and regulating the depth of trench dug by the excavator. Reference to the photograph above will help make the operation clear.

The entire process from start to finish is automatic as in addition to digging the trench and laying the cable, a drag attached to the rear of the plow turned the dirt back into the trench, thus completely filling it and thoroughly covering the cable that had been laid in place.

Unwinding from a spindle, cable is directed by a tube into the trench without manual assistance



HEAT RESISTING GLASS MADE FOR AIR BEACON

SPECIAL heat resisting glass has been designed to stand up under the extreme temperature of a giant rotating aerial beacon. The dome-shaped cover of this huge light of 1,075,000 candlepower is so large that a woman can easily get her head and shoulders inside it. In shape it resembles the bell glasses used to cover wax flowers in parlors of the nineties. It will be used to protect the moving parts of great air beacons.

TOE AND HEEL GUARD PROTECTS STOCKING

A NEW stocking protector resembles a soft bedroom slipper. Fitting over the foot, it provides a covering at heels and toes. Since it is soft and flexible, the wearer experiences no discomfort from its use. In winter it gives added protection against cold.

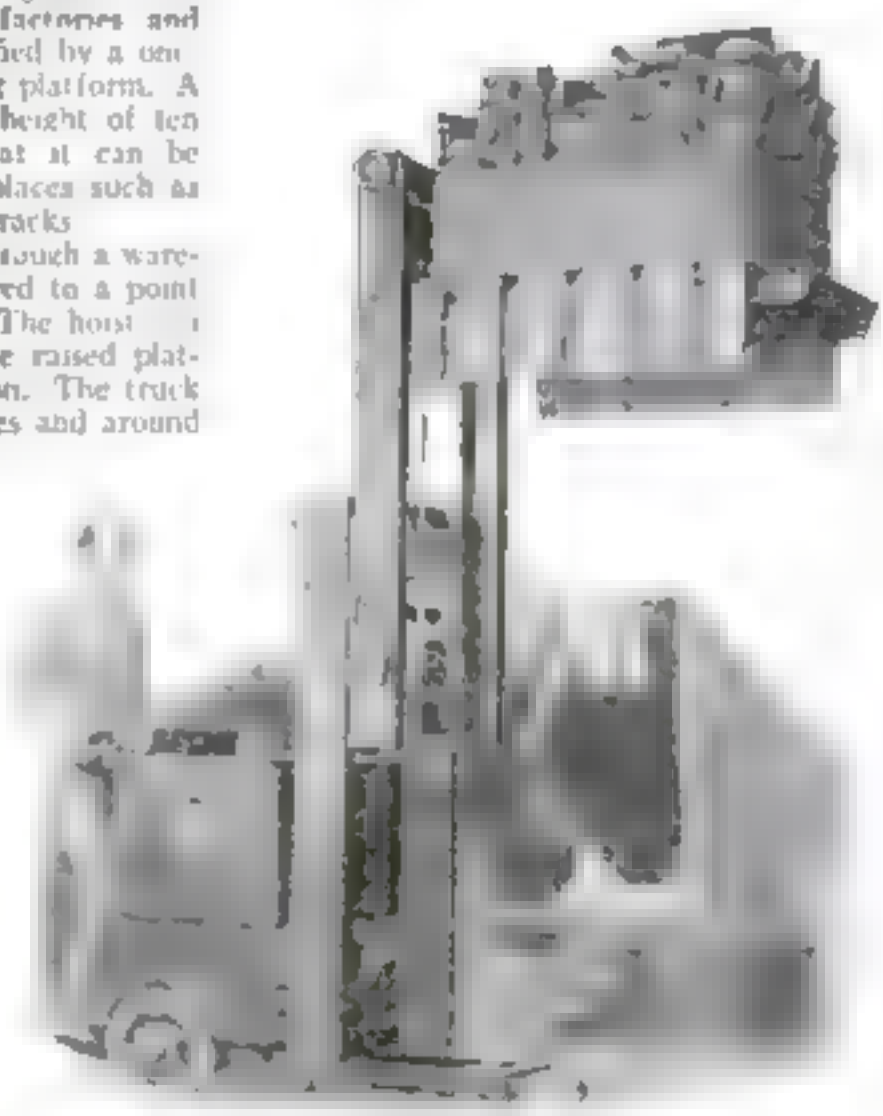
EROS VISITS THE EARTH

THE asteroid Eros, which next to the moon is earth's nearest neighbor in the heavens, is now closer to us than it has been for the last thirty years. But this asteroid, or tiny planet, is still about 13,500,000 miles away and cannot be seen by the unaided eye. Eros was discovered August 14, 1899, and it is probably not more than twenty miles in diameter.

CAN RAISE BED OF ONE-MAN TRUCK

LOADING and unloading freight cars and carrying material around factories and warehouses has been simplified by a one-man truck with an elevating platform. A power hoist raises it to a height of ten feet from the floor so that it can be loaded directly from high places such as railway cars or stockroom racks.

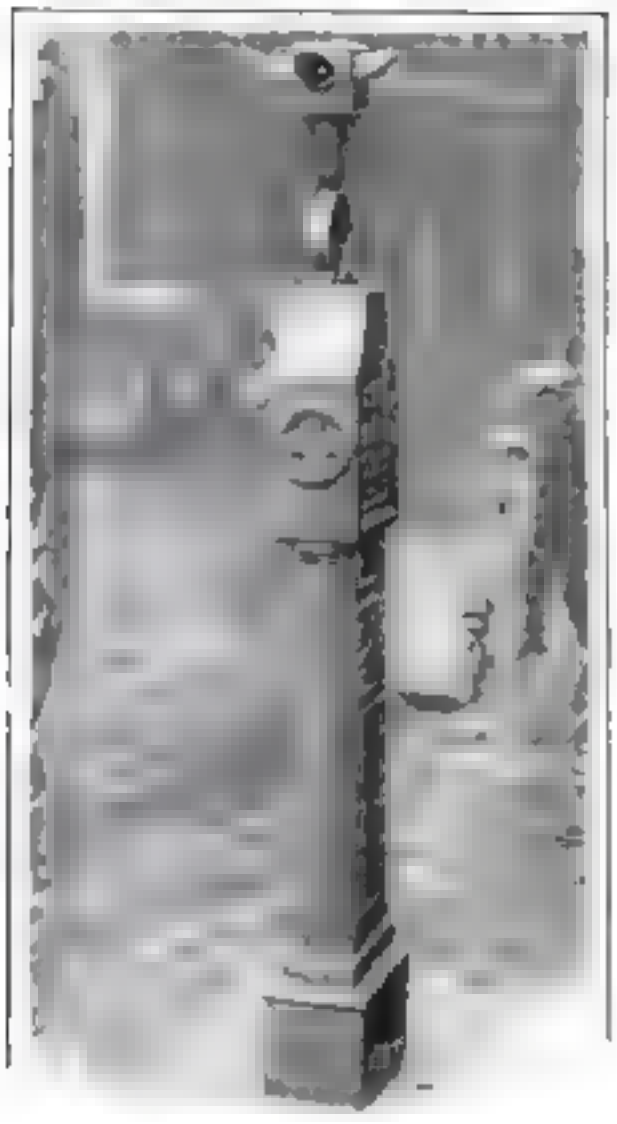
When loads are carried through a warehouse the platform is lowered to a point a few feet from the floor. The hoist [illegible] be operated either from the raised platform or the driver's position. The truck gets through narrow passages and around sharp turns easily because of its short wheelbase.



The movable platform on this one-man truck makes it easy to load and unload freight at various elevations.

PAINT DRIES LIKE LACQUER

A RAINSTORM may arrive soon after a house is painted, yet it will not harm the surface of a paint recently placed on the market by an Eastern firm. This finish dries with the rapidity of household lacquer. A special oil, developed by laboratory research, is the base of the new paint. It is adaptable for interior or exterior use and can be applied with either paintbrush or spray-gun.



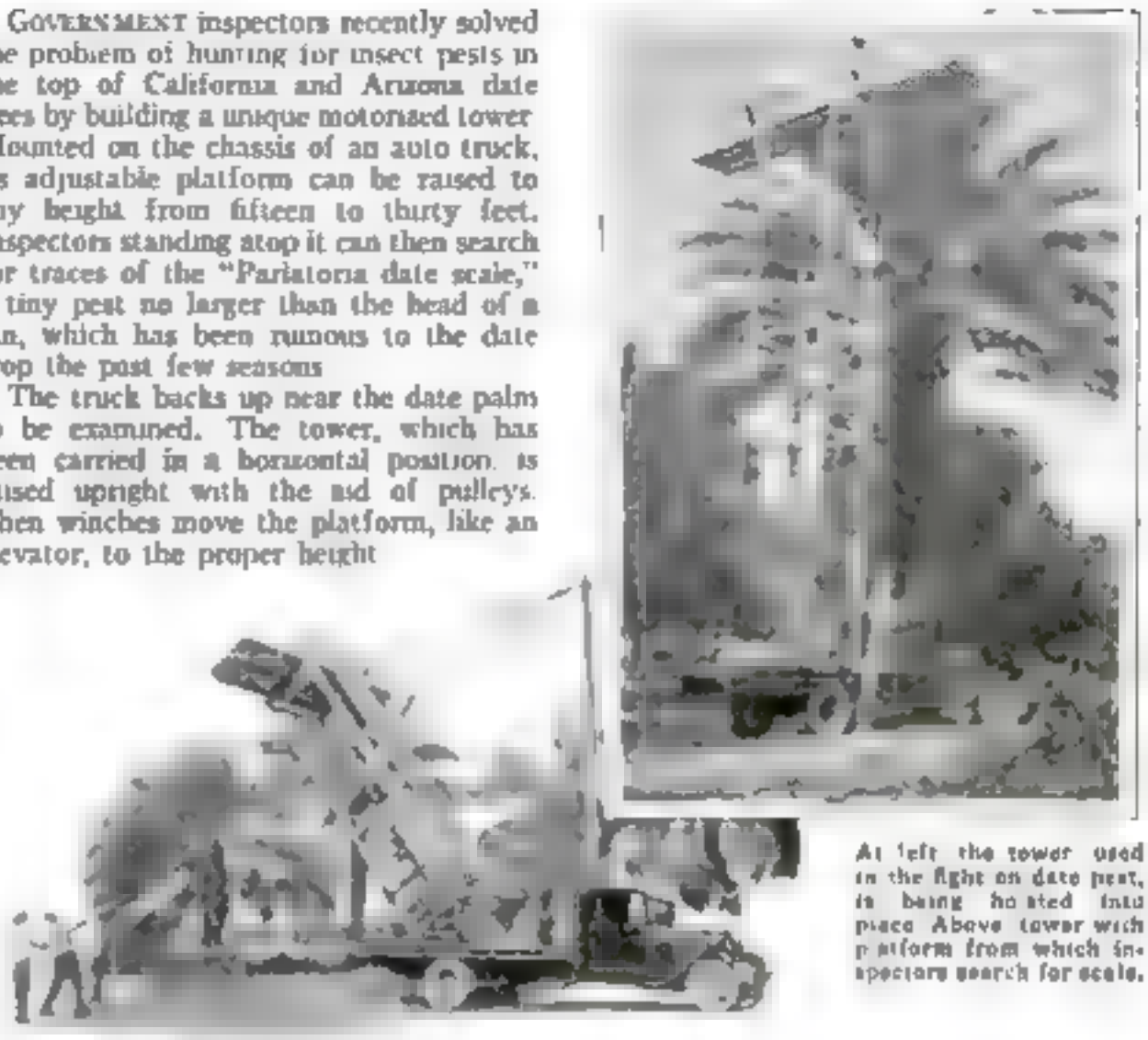
LONDON STREET POST CALLS POLICEMAN

HERE is a new type of "alarm post" now being tried out in the streets of London. When headquarters wants to get in touch with the policeman on the beat, a blue light flashes and a bell rings continuously until the officer gets in touch by phone. The use of a bell signal in addition to a flashing light is a novel improvement on the system in use in New York and other American cities where only the flashing light is employed to attract the attention of a near-by patrolman.

USE TOWER TO FIGHT DATE PEST

GOVERNMENT inspectors recently solved the problem of hunting for insect pests in the top of California and Arizona date trees by building a unique motorized tower. Mounted on the chassis of an auto truck, its adjustable platform can be raised to any height from fifteen to thirty feet. Inspectors standing atop it can then search for traces of the "Parlatoria date scale," a tiny pest no larger than the head of a pin, which has been ruinous to the date crop the past few seasons.

The truck backs up near the date palm to be examined. The tower, which has been carried in a horizontal position, is raised upright with the aid of pulleys. Then winches move the platform, like an elevator, to the proper height.



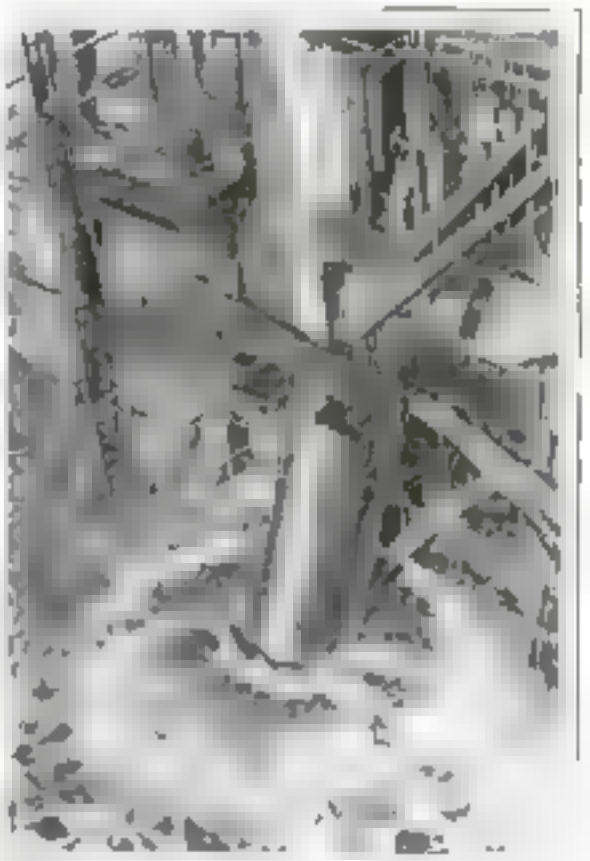
At left the tower used in the fight on date pest, is being hoisted into place. Above tower with platform from which inspectors search for scale.

RAISED TRACK SECTION IS BRIDGE

A CROSS-OVER table between two freight platforms—a bridge in the "raised" position and part of two railway tracks when lowered—was recently designed by an Illinois engineering firm. It is elevated by four electrically-driven screws.

The picture shows a train of trucks being operated over the bridge when it was raised. When lowered freight cars pass over it on both tracks. Use of this "bridge" has made it unnecessary for freight-loaded trucks to travel the entire length of freight stations in order to cross from one platform to another.

A section of track is raised to make a bridge upon which trucks cross.



TIDES FILL TANKS TO OPERATE TURBINES

AT AVONMOUTH, England, where the tide rises and falls thirty feet, a British inventor recently built a strange power plant to harness the sea. When the tide rises, it captures sea water in tanks and holds it until the tide falls. Before the water can get back to the sea it must drop through a shaft and run a turbine connected to an electric generator. In this way the designer of the experimental plant, Paul Shushkoff, obtains from fifty to 250 horsepower free, according to the state of the tide.

PORTABLE X-RAY RUN BY ENGINE IN AUTO

WHEN a physician races to the scene of a road accident where facilities for a thorough medical examination are not available near by, a new portable X-ray outfit enables him to learn at once the extent of a patient's injuries.

A rear wheel of his car, jacked up, furnishes power, when the engine is going, to run its electric generator. Five minutes after his arrival, he is ready to check up on broken bones with his handy outfit.

MIDGET GOLF SCORER CLAMPS TO CLUB SHAFT

LATEST of the inventions which miniature golf has brought with it is this handy scorer, which ends disputes about the number of strokes a player has taken and saves the trouble of keeping a penciled score card. The device is attached to the handle of the golf club and after each stroke the player presses a small button on the scorer. Within the device is a small card to carry a full record of eighteen holes, and each stroke is punched on the card under the proper hole. After a round, the card gives a complete record of the player's score—provided the player remembered to punch for each stroke. It does not interfere with the use of the club, since it is only two and a half inches in diameter and weighs three ounces.

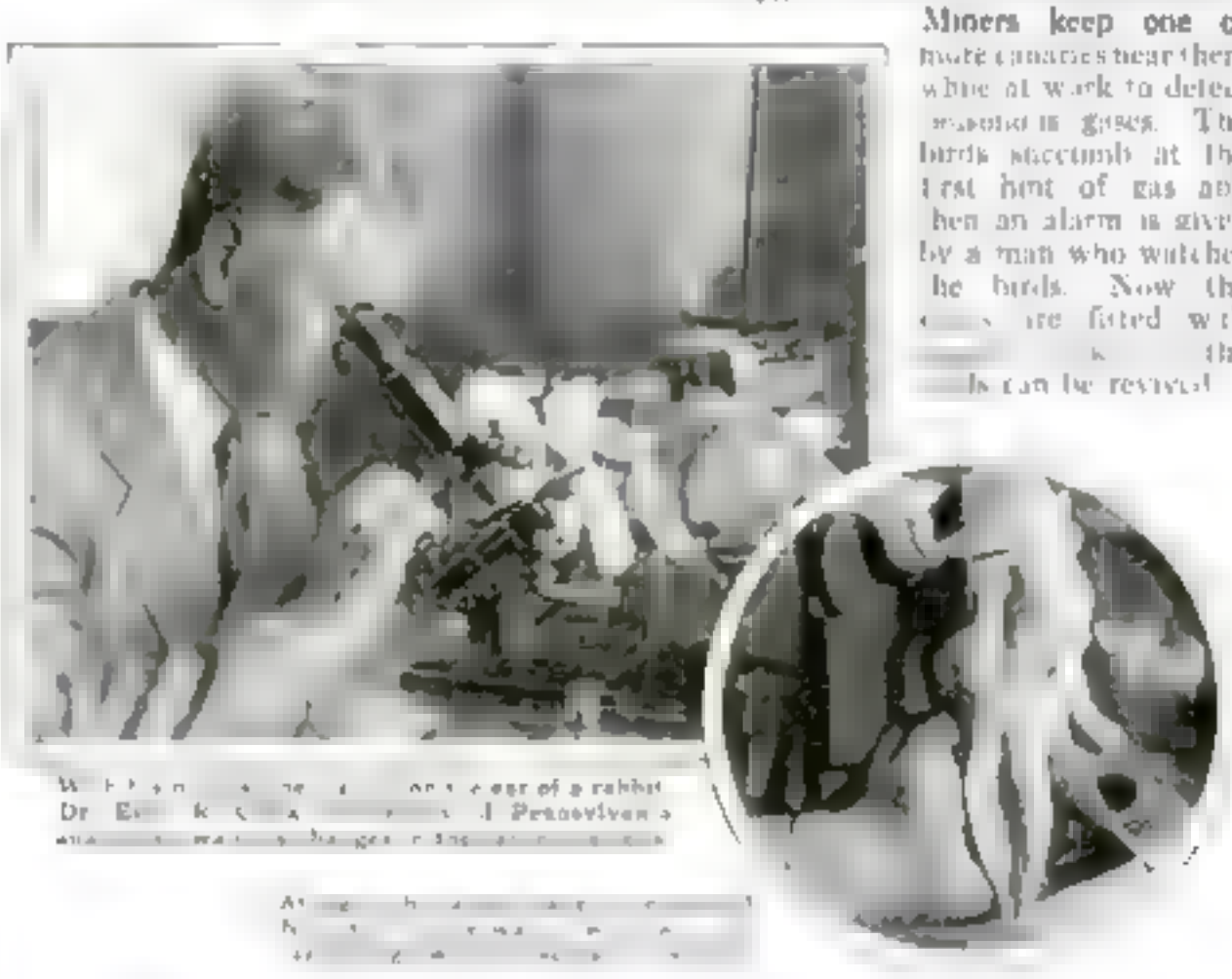
STUDIES SICK CELL IN RABBIT'S EAR

WATCHING the growth of microscopic body cells on a living animal is the feat of Dr. Eliot R. Clark, University of Pennsylvania anatomist. He recently provided a rabbit with a transparent, double-walled window in its ear so that he might study the cells that grew in a space only two thousandths of an inch thick between a wall of glass on one side and a thin sheet of mica on the other. This method enables him to study the abnormal behavior of cells due to cancer and tuberculosis. He developed the method in collaboration with his wife.

Hitherto it has been necessary to remove anything as small as a body cell and place it on a glass slide to see it under a microscope. Now, however, Dr. Clark can train his microscope on a rabbit's ear and watch the growth of bone cells which he transplanted there. Eventually he hopes to observe human cells in the same way, and he proposes to use one of his own hands for the experiment.

SAFETY CAGE FOR BIRDS

CANARY birds now have cages equipped with oxygen tanks for use in British mines. Miners keep one or more canaries near them while at work to detect poisonous gases. The birds succumb at the first hint of gas and then an alarm is given by a man who watches the birds. Now the cages are fitted with [illegible] the birds can be revived.



With [illegible] ear of a rabbit Dr. [illegible] Pennsylvania [illegible]

REVIEW DIVERS BEFORE A PLUNGE

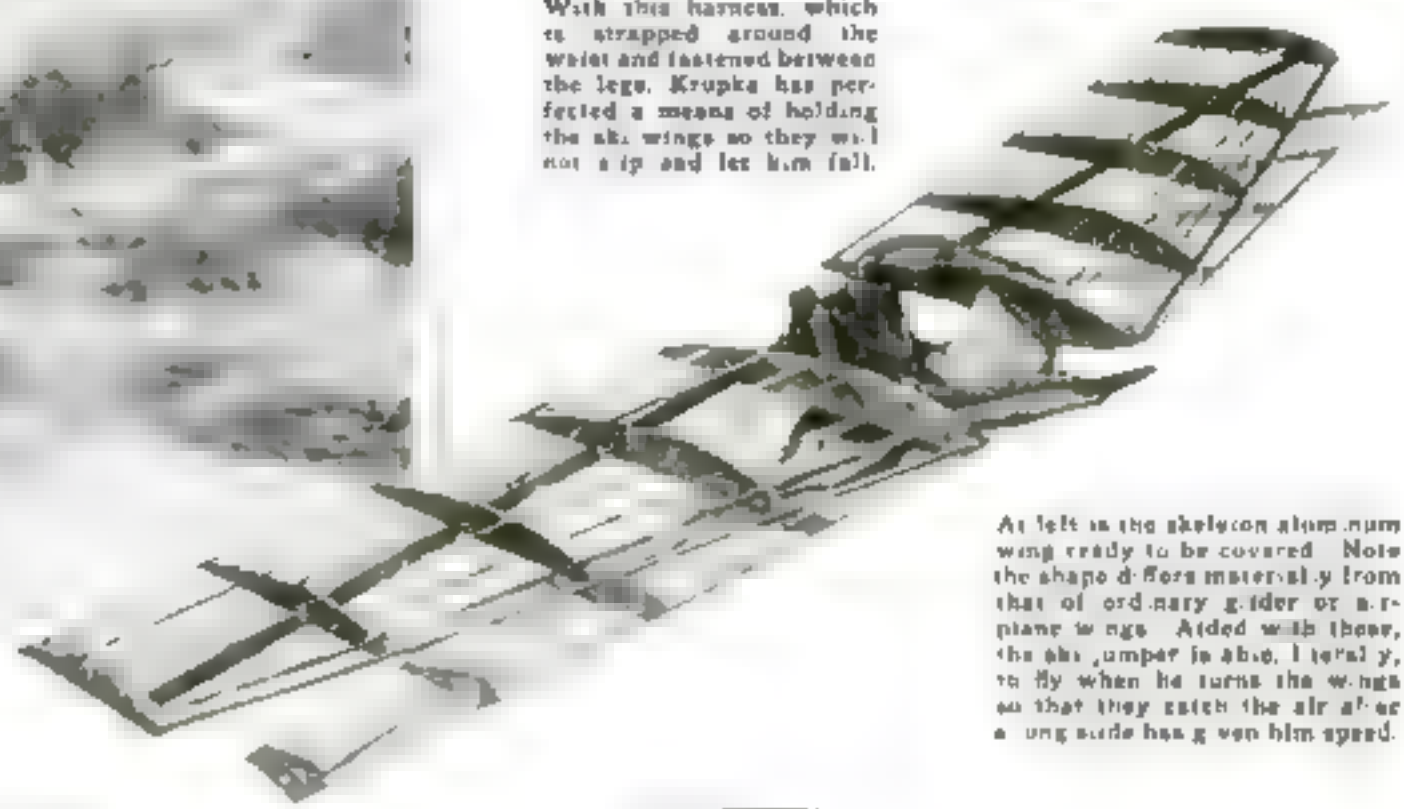
Attired in their grotesque suits, these German divers stand on review before taking to the water on a deep-sea training plunge

STRANGEST of sights in the German navy is a group of apprentice divers clad in their grotesque helmets on review before a dive. This unusual picture shows them receiving final instructions before going underwater. Since a policy of the new German navy requires one qualified diver in each torpedo boat, a large [illegible] of deep-sea divers is undergoing training at the naval base in Kiel. Each member of the class is given a bronze medal on completing the course.

Wings on Skis Add New Glamour to Winter Sport

Spreading his aluminum wings, designed by himself, Joseph Krupka Viennese skier, soars for hundreds of feet down the side of the Alps.

With this harness, which is strapped around the waist and fastened between the legs, Krupka has perfected a means of holding the ski wings so they will not slip and let him fall.



At left is the skeleton aluminum wing ready to be covered. Note the shape differs materially from that of ordinary glider or airplane wings. Aided with these, the ski jumper is able, literally, to fly when he turns the wings so that they catch the air after a long slide has given him speed.

Thrill seekers, looking for something new to try, may now go skiing with wings. Joseph Krupka, Viennese dare-devil, recently showed how it could be done. Whizzing down the side of a glacier in the Austrian Alps he reached express-train speed. Then he tilted aluminum wings of his own design, and for hundreds of feet soared over the snowy tracks, landing near the foot of the slope.

Never a tame sport, skiing becomes doubly thrilling when it takes to the air, as the wings greatly increase the distance a skier can jump.

The wings support the body through a harness resembling a corset. Webbing is strapped around the ski-flyer's waist, while straps pass between his legs and buckle to prevent the wings from pulling the harness off him. Krupka steers himself in flight by movements of the body.

GLASS MAY BEAT SLATE AS SCHOOL BLACKBOARD

EITHER glass or porcelain, instead of slate, may be the future material preferred for school blackboards. A new method of making glass blackboards overcomes previous objections to this material. The glass is hardened by addition of a mineral called black chromite, which prevents it from wearing smooth and gives it a sufficiently rough surface to facilitate writing with chalk. Colored blackboards of porcelain are a recent innovation, latest development in the enameling industry.

BEETLES IMPORTED TO KILL WEEDS

INSECTS, imported by the thousands, now devour the prickly pear cactus in Australia. This novel step was taken after the weed had turned sixty million acres into a jungle, and was spreading at the rate of a million acres a year. Longicorn beetles and other insect enemies of the cactus released in the fields are expected to wipe out the pest.

Weed control by insects is new, but already successful in other lands. Insects from Mexico conquered the lantana, a weed infesting Hawaii sugar plantations.

At right, the longicorn beetle imported into Australia to kill worthless cactus.

Sixty million acres of valuable farm land has been turned into a jungle in Australia by the rapid spread of the prickly pear cactus which ruins a million acres a year.

STEAM CRANE RUN WITH NO FIRE UNDER BOILER

A STEAM crane without a fire under its boiler was used on a construction job in an Oklahoma refinery the other day. Gasoline fumes about the plant made the use of fire impossible so the crane's engines were run with steam supplied by a line from the refinery's boiler house. Construction of new storage tanks in a narrow space between two buildings necessitated use of the crane

WORK FOR CENTURIES TO GET MODERN GOLDFISH

EXPERIMENTS made by Chinese goldfish breeders during the last nine centuries have paralleled the work of modern biologists, according to a report of the Field Museum of Natural History, Chicago. Goldfish were first introduced into Europe about two centuries after the discovery of America

The Chinese have brought the goldfish to its present high state of domesticity by their knowledge of the art of interbreeding. All the present varieties of this decorative household pet owe their existence to Chinese skill and industry in this art

In China goldfish are always kept in garden ponds or porcelain bowls

MIDGET GOLF TO GET STEEL GREENS

[illegible] may be pla[illegible] as the result of an inv[illegible] Sm[illegible]h, and our go[illegible]. He has invented a n[illegible] up of about [illegible] and other mineral, cut up fine in imi[illegible] grass. It is colored with [illegible] increase its resemblance to the well-kept turf on greens of outdoor golf courses. The new grass, according to its inventor, is the closest imitation of natural grass yet found

A new material designed for the greens of indoor golf courses is composed of eighty percent steel shavings. Painted green it is said to offer a playing surface that compares well with actual turf outdoors.

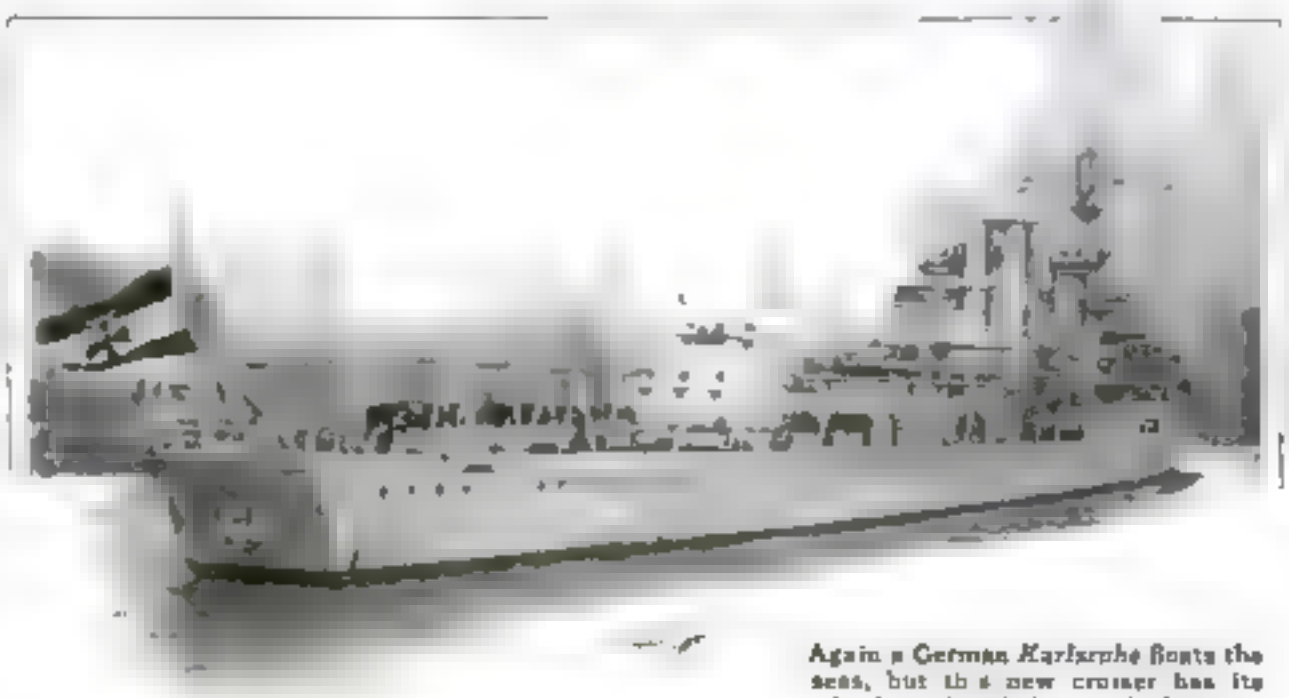
RUN ELECTRIC PLANT AT 3,200 POUNDS PRESSURE

GENERATING plants in the United States producing electricity commercially now work under pressures as high as [illegible] pounds per square inch. Such pressures have been developed in the search for efficiency. The average steam locomotive today operates under pressures of from two to three hundred pounds to the square inch. Pressure of 3,200 pounds per square inch equals by comparison the weight of a large locomotive on one square foot of surface.

PUSH BUTTONS STEER NEW CRUISER

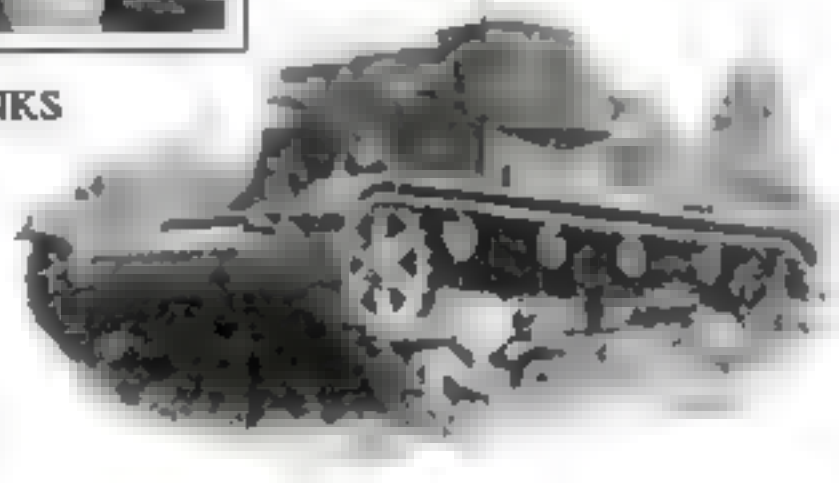
A NEW German light cruiser, the *Karlsruhe*, has attracted much attention in naval circles because of the unusual features of her design. Her steering gear is of electrical type, no wheel being used to keep the vessel on her course. The helmsman guides her by two push buttons, one to work the rudder to port and the other to work it to starboard, or left and right as steering orders are given in the German navy

In the event of war, the ship can be used as a mine-layer, having been given an odd-looking stern and an unusually clear afterdeck to facilitate the handling and dropping of mines. She is equipped with gyrocompasses, having one "master" compass and twelve "repeaters." The new and up-to-date *Karlsruhe* is named for a German light cruiser that was lost during the World War.



Again a German *Karlsruhe* floats the seas, but th s new cruiser has its wheel replaced by push buttons.

Below, British radio-equipped tank, showing aerial. At left the set in operation with tank in movement.



BRITISH ARMY TANKS GET RADIO SETS

ONE of the latest military developments of radio, according to British engineers, is the installation of transmitting and receiving sets in army tanks. Portable sets are used, working on a wave length of seven to eight meters. The aerial, which is twelve feet high, is so thin that it is invisible from a short distance. A special mounting had to be devised to enable the delicate apparatus to withstand the jolting it was subjected to in the course of a cross-country journey

This equipment proved of great value to tank operations, a fleet commander being always within touch of each unit in his corps.

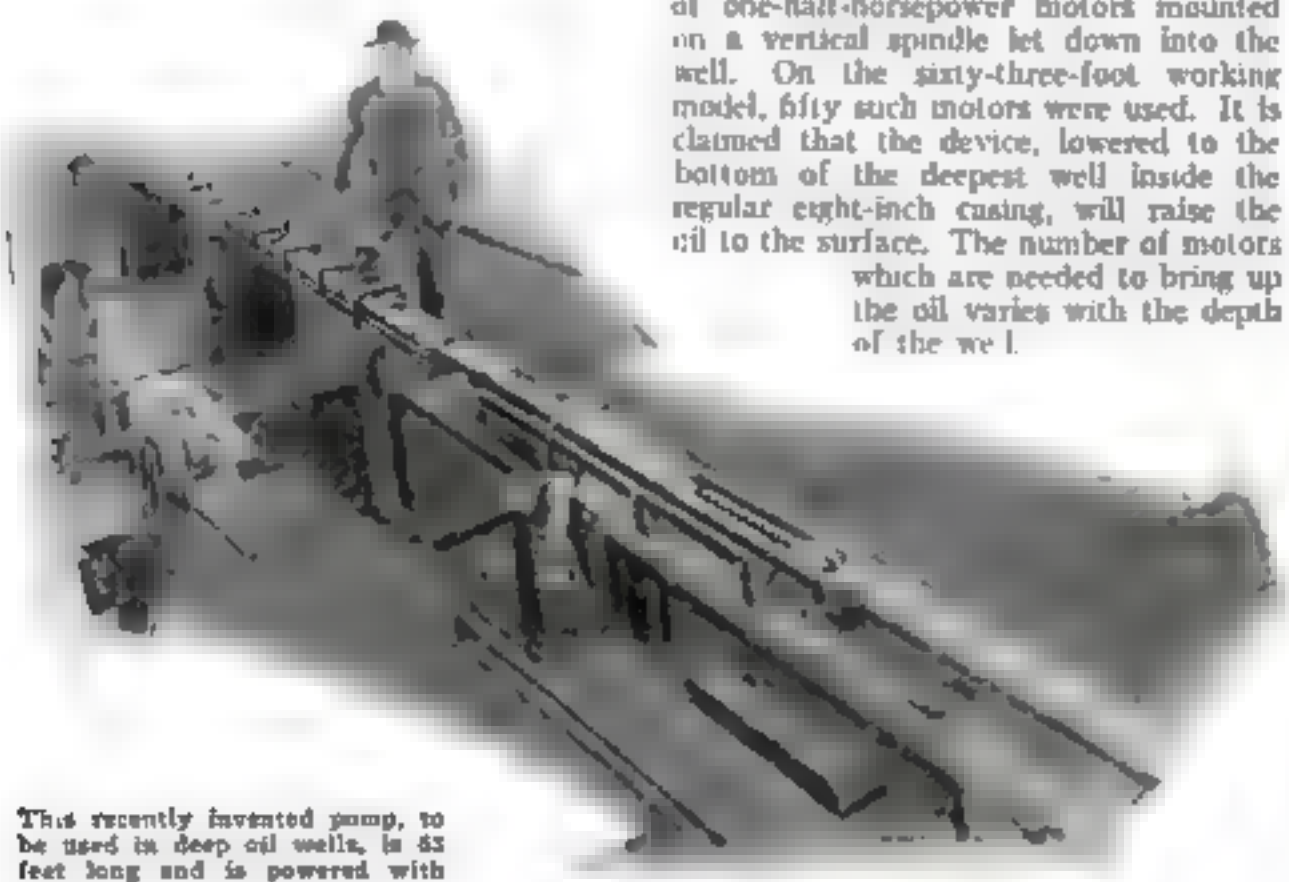
FIRST COLOR PICTURES TAKEN FROM THE AIR

CAMERA men recently made the world's first aerial color photographs They snapped the National Capitol at Washington, D. C.; the Statue of Liberty, in New York harbor; and scenes along the Atlantic coast in their natural colors. The pictures were taken from the U. S. Navy's all-metal blimp *ZMC-2* and the Goodyear-Zeppelin dirigible *Mayflower*. Dirigibles were used for this work in preference to airplanes since their slower motion prevented blurring of the pictures. Even then, the color pictures were made possible only by a newly-perfected process of color photography using high speed plates that permitted snapshots as rapid as 1/35th of a second.

Natural-color aerial photographs may become important both to highway and military engineers, as their color aids map makers. It is believed by army men that they would be particularly valuable in mapping an enemy's country.

FIFTY MOTORS OPERATE DEEP OIL WELL PUMP

RAISING oil from wells too deep for the operation of existing pumping machinery may soon be accomplished by a new deep-well rotary oil pump recently developed in San Francisco. It is driven by a series of one-half-horsepower motors mounted on a vertical spindle let down into the well. On the sixty-three-foot working model, fifty such motors were used. It is claimed that the device, lowered to the bottom of the deepest well inside the regular eight-inch casing, will raise the oil to the surface. The number of motors which are needed to bring up the oil varies with the depth of the well.



This recently invented pump, to be used in deep oil wells, is 63 feet long and is powered with fifty one-half horsepower motors.

ELECTRIC FURNACE NOW HEATS BUILDING RIVETS

Even temperature of rivets is had in electric heater which may replace present coal forge.

COAL-BURNING rivet forges may soon give way to electric rivet heaters recently developed in Chicago The new furnace is said to bring rivets to an even, uniform heat more quickly and economically than is possible with coal furnaces, where the heating of rivets depends on the judgment of the men working them. They will also largely eliminate the fire hazard always present where there are open coal fires

PUMP IN BIKE SADDLE INFLATES TIRES

BY WORKING the saddle up and down, the tires on a bicycle can be inflated with a new built-in pump just developed in England. The cylinder of the pump is part of the wheel's frame, being placed just forward of the post that supports the saddle, as shown in the photo above

A clamp on front or rear fork locks either wheel with its air valve in position to be reached by the discharge tube from the pump. Pumping up tires by this method is easier than it is with the old-style plunger pumps. Either tire can be pumped up as desired and when the pump is not in use, the saddle clamps fast in position for the rider

SKIRT OF BATHING SUIT IS LIFE PRESERVER

A novel dress for water sports resembles a huge wine glass in shape. It is secured about the wearer's waist and flares upward around the body. When the wearer gets into water that is over her depth she has only to turn upward the flexible hoop-braced skirt as shown in the illustration above keeping her arms inside it, in order to float

The fabric is rubberized to make it waterproof. With the aid of this unusual costume, a swimmer can apply make-up while floating, protected from the waves and hidden from view of spectators.

FILM SHOWS CAR HIT BY TRAIN

Getting ready to make the sound film of a crash of engine and car. The film is used in California's safety program.

Below, the thrilling spectacle of the

one was injured, for cameras and engine were stopped while the driver escaped before the automobile was struck

NEW TENNIS RACKET IS MADE IN TWO PARTS

A TENNIS racket that can be taken apart and packed in a suitcase has been invented in England and has proved a great convenience for vacationists and others who carry tennis equipment with them when they travel.

The head of the new racket screws into the handle at the throat. It is locked in place by a special device that prevents it from loosening while in use. When it is assembled and ready for play, it looks like any standard racket, the joint being practically invisible

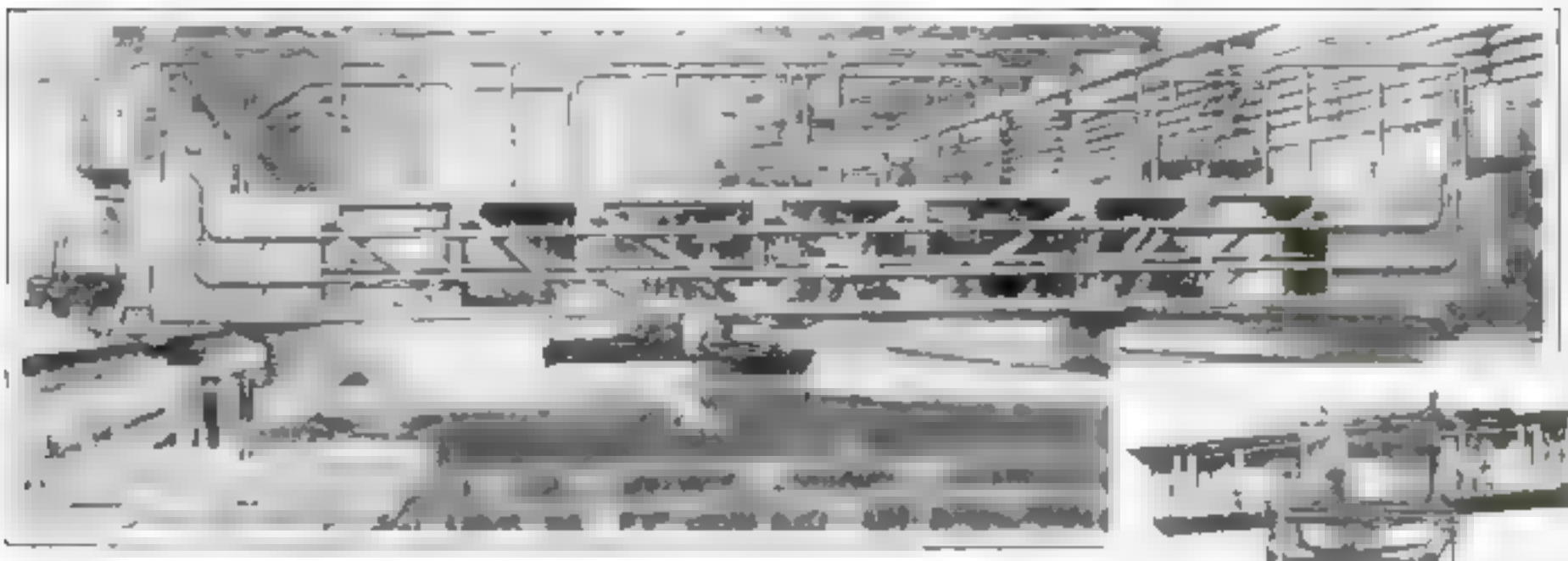
Here is something new in a tennis racket. The detachable handle makes packing easy.

DYNAMITE CHIMNEY NEAR CAPITOL

This unusual photograph shows a chimney in Washington, D. C., just as a charge of dynamite sent it crashing to earth.

A TWO-HUNDRED-FOOT chimney was recently destroyed by dynamite in Washington, D. C., as part of a program for beautifying the surroundings of the United States Capitol. This project involves the expenditure of millions of dollars for the destruction of old buildings, the construction of new ones, the laying out of parks, and the improvement of Government property in the vicinity

Removing tall chimneys with dynamite is now an exact science. Charges can be placed so that the structure will fall exactly where it is wanted, without the assistance of guy ropes or pulling apparatus and without any chance of the falling bricks damaging other property in the neighborhood.

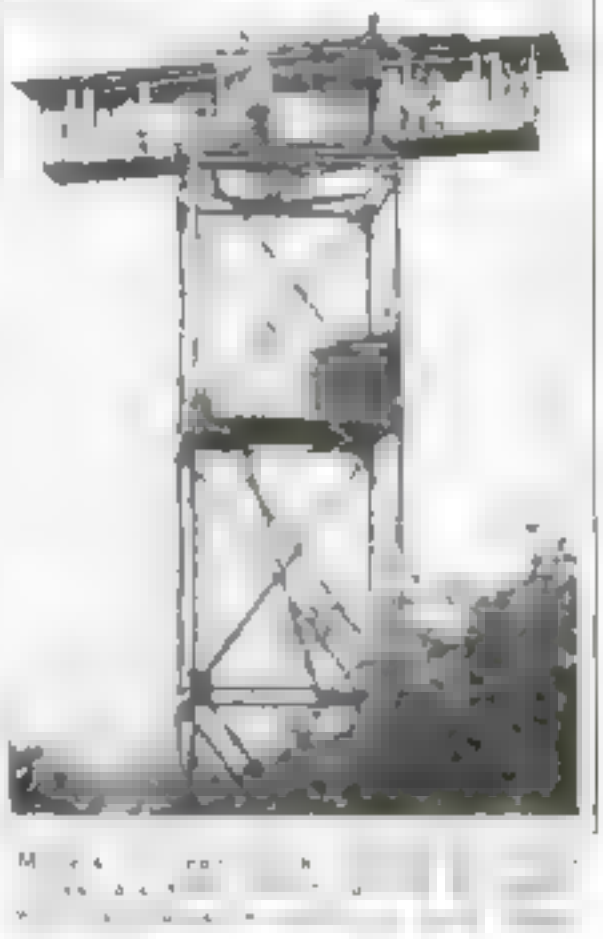


ENGLAND SEEKS FAST SHIP DESIGN

At the National Physical Laboratories in Teddington, England, British naval architects are preparing designs for superliners with which they hope to wrest the speed record of the Atlantic from Germany's express [illegible] liners. Scale models, [illegible] present an weight and [illegible] ships, are towed through [illegible]

Models of the proposed ships upper [illegible] also made and tried on the [illegible]

ture at the right. This shows the [illegible] ocean winds that part of the ship which is above the water line. By means of information obtained here masts, funnels [illegible] ged and shaped [illegible] vessel at any required [illegible]



SUSPENDERS KEEP SHIRT DOWN, TROUSERS UP

A new device supports trousers and keeps shirts in place without belts or ordinary suspenders. Two small fastenings, known as "hip suspenders," are attached inside the waistband of the trousers on either side. They may be snapped or sewed in place. These are clipped to the shirt's side seam at any point to suit the wearer, the shirt then keeping the trousers up and the trousers keeping the shirt down. A comfortably loose belt may be worn for appearance' sake.

The fastenings, according to the maker, improve the wearer's appearance and comfort because they make his clothes fit better and are so small that he is unconscious of wearing them.

U. S. INFANTRY EQUIPPED WITH ELEVEN WEAPONS

[illegible] equipped with [illegible]. The picture [illegible]

The figure on the left of the front line is firing a rifle; the man in the center is ready with the bayonet; and the man on the right is firing an automatic rifle. The man at the extreme left of the next rank toward the rear is working a one-pounder [illegible] is firing a pistol.

[illegible] on the extreme right is [illegible] gun. In the rear rank the [illegible] is firing a smoke bomb [illegible] tank comes up at the right. To the right is a man firing a trench mortar, and the figure at extreme right is firing a grenade from a rifle.

NEW PROCESS GETS GAS FROM COAL INSTANTLY

A time-saving method of making coal gas, or illuminating gas, has been developed by Professor Alfred White, of the [illegible] of Michigan. Pulverized coal [illegible] retorts which have first been brought to a red [illegible] by-product of [illegible] instantaneously produ[illegible]

[illegible] a lengthy process, [illegible] is used slowly.

Eleven deadly weapons of warfare are carried by the American doughboy and each of them from smoke bomb on the extreme left, next the tank, to the machine gun on the right, is shown above.

BUOY IS LIFE-SAVER FOR SUBMARINE CREW

A buoy large enough to contain one man was recently demonstrated as a submarine escape device by Captain Torruella, of the Spanish navy, at Cartagena, Spain. In the event of accident, a member of the crew climbs into it and it is ejected from the submarine by compressed air. Each man would have his own individual "life preserver."

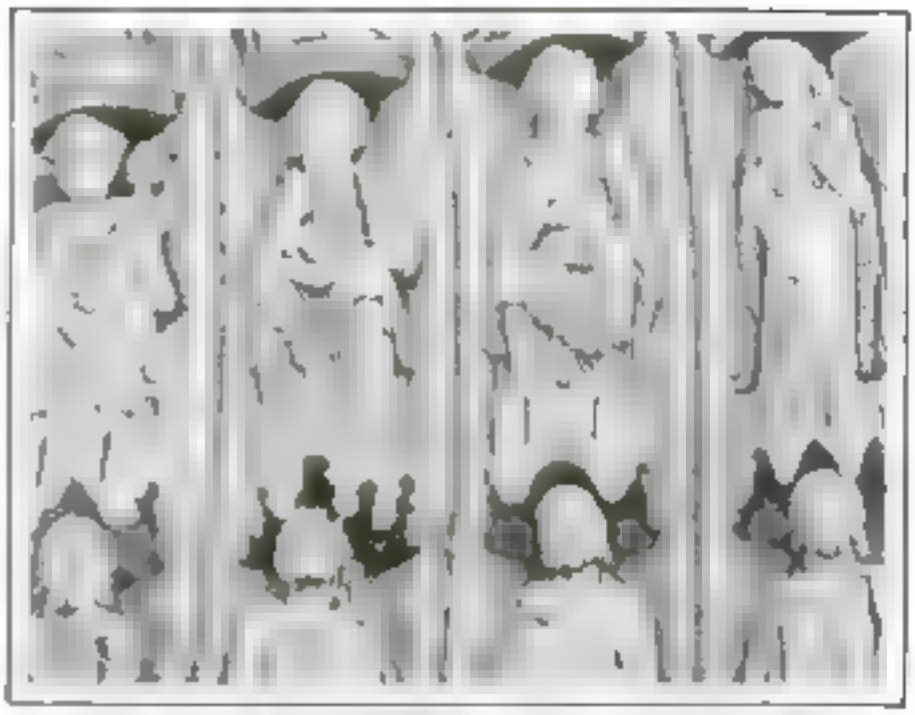
The upper photo shows Captain Torruella emerging from his buoy, which has just been secured by an attendant vessel.

REVOLVES AUTO ENGINE AS MECHANIC WORKS

WHEN a mechanic is adjusting bearings from beneath a car, it is a nuisance for him to crawl out and turn the motor over. An electrical device now does it for him. The mechanic slides under the car, taking with him a control switch on an extension wire. A push on the button, and an electric motor turns the car's engine over. The device is useful also in grinding valves and loosening up a tight motor, then being worked from alongside the car.

EINSTEIN STATUE AT CHURCH DOOR

A STONE carving representing Professor Albert Einstein, world-famous scientist and mathematician, forms part of the decoration over the main entrance to the new "Rockefeller Skyscraper" Church in New York City. Professor Einstein is the only man now living who has been honored by having his statue placed in the church although there are so many figures of famous men of arts and sciences of past ages that eighty-five stone carvers worked three years to finish them.



At door of the Rockefeller Church, New York appears statue of Einstein, seen as second upper figure from right.

Mat for running board or porch cleans easily

DOORMAT WITH BASE IS EASILY CLEANED

[illegible]rmat, for the running [illegible] car, that lifts for cleaning [illegible]s of dirt has accumulated [illegible]he hinged grate swings upward out of the way to allow its removal with a small broom.

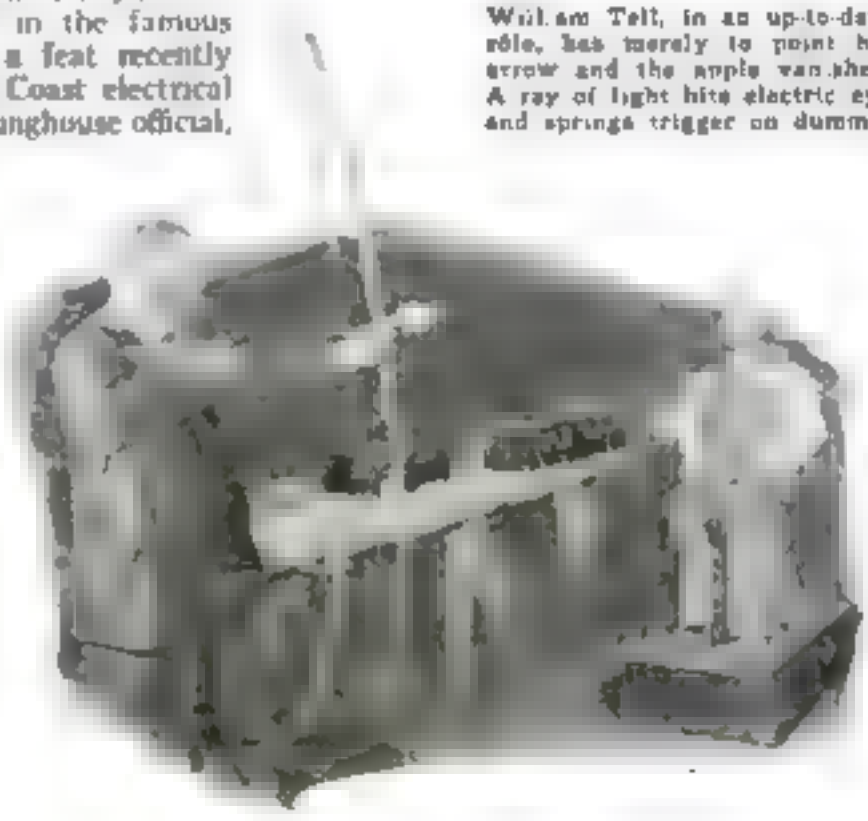
In ordinary use stiff bristles remove the dust from the user's shoes. The dirt seeps between the grates of the metal frame into the base. Mats of the same new type are now available for doorways of homes and of public buildings, where their use should save time in cleaning and keep the floors free of dust.

ELECTRIC EYE AIDS MODERN TELL

KNOCKING an apple from a boy's head with bow and arrow, as in the famous William Tell scene, was a feat recently duplicated before Pacific Coast electrical men. S. M. Kintner, Westinghouse official, aimed an arrow containing a flash light at the head of a dummy figure. The narrow beam fell upon a sensitive electric eye concealed in the figure. A relay clicked. Then a hidden trigger flipped the apple from the head of the dummy.

The demonstration was part of an exhibition on suggesting the possibilities of the photo-electric cell or electric eye, which operates devices in response to light.

William Tell, in an up-to-date rôle, has merely to point his arrow and the apple vanishes. A ray of light hits electric eye and springs trigger on dummy



CHURCH HAS SOUNDPROOF ROOM FOR CHILDREN

[illegible] tion. The room shown in the [illegible] graph, is built in the rear wall of the church above the congregation and facing the pulpit. Its front is made of plate glass affording a view of the service. No sound made in it however can escape in the church, so parents have no fear that their children will disturb the congregation.

Occupants of the mothers' room hear services as well as see them because hymns, prayers, and sermons are broadcast to them by a loudspeaker connected with a microphone directly above the pulpit. The microphone installed in the pulpit is shown in the lower photograph.

Soundproof room for mothers and children in Los Angeles Carl church is shown at the top. Above microphone on pulpit which makes service audible in the enclosed room.

SQUAD TAUGHT TO USE GAS MASKS

LOCKSTEP like members of some strange religious cult at their rites, the members of this German gas mask squad are being taught to breathe with their antigas contrivances in place. The class is run by a large German gas works.

The course, lasting two days, is taken advantage of by gas workers and firemen. Students are given instructions so they can recognize the scent of deadly fumes, and are shown how to detect those that have no odor.

POCKET CHECK BOOK HAS PERMANENT BLOTTER

INK blots on checks and stubs are avoided by a new blotter that is permanently attached to the binding of a pocket sized check book.

When a check is written, the hinged blotter is folded beneath the last stub, and pressing it down blots the new one. Then the blotter is unfolded and used to blot half the check. Lastly the other half of the check is folded back upon the upper surface of the blotter and dried.

Hinged blotter in this pocket check book folds around stub and automatically blots it.

FIND NEW YORK IS LOW AND NOT CONGESTED

NEW YORK subway travelers and "cliff dwellers" may find it difficult to agree with the result of a recent survey of their city which was made by a regional planning commission. This body found that America's largest city is not the congested center of population it is supposed to be and that the average height of buildings on Manhattan Island, in spite of towering skyscrapers, is but five stories.

It also found that only seven tenths of one percent of all buildings in the city were elevator apartments and hotels and that sixty-eight percent of the buildings were one- and two-family dwellings. A great majority of the inhabitants of New York said the commission's reports live in comparatively low buildings, and nearly half of them live in houses that have ample space about them for light and the circulation of air.

PENCIL HOLDER SERVES AS LETTER OPENER

WHEN the hinged clip of a new style pencil is turned backward, it serves as a letter opener. At other times it holds the pencil securely in the pocket.

The combination pencil is standard pocket size, with eraser compartment for extra leads, and adjustable lead. Its clip is so mounted that it permanently retains its tension.

The Architect Builds His Own Home—A Series

First Make Your House Livable

Second-floor landing of stairway. A concealed radiator is beneath the window that lights the hall.

The stair curve is so gradual that variation in width of tread is relatively slight

A Long Island Expert Tells of the Dwelling He Built and Offers Useful Hints to Home Makers

By

H. T. ASPINWALL

EVER since the first cave man got a firm grip on the flowing locks of his stubborn bride and dragged her into a near-by cave, people have been arguing about what constitutes an ideal home. As an architect specializing in homes, I have had a ringside seat at many of these arguments.

The difficulty seems to be that most people cannot realize that building a home always is a matter of compromise. Both husband and wife inevitably have certain pet ideas even when they agree as to the particular neighborhood in which the house is to be built. Almost invariably the cost of the house must be held to some definite figure.

My job is, therefore, to design a house that will incorporate as many of the desired features as is physically possible within the set price. Due attention must be given to what I call the hidden features in a house, that is, the details of construction which I, as an architect, know must be considered if the house is to be a satisfactory home. Moreover, while considerable latitude is possible in the outside appearance of a house, it necessarily must be in keeping with the general character of the neighborhood and the homes immediately surrounding it.

A house becomes a home only if it has the quality called livableness. It was with the intention of seeing how livable I could make a home that I set out to build the house pictured on these pages. While the particular price class into which my home fits may be either above or below your own requirements, the same principles are involved regardless of price.

This fireproof door opens from the lower hall directly into the two-car garage, seen beyond.

BEFORE I describe the problems confronting an architect in building his own home, I want to say a few words as to the relative expense of buying a house already built as compared with a house built according to your own ideas as interpreted by a good architect. When you buy a house the job is finished when the sale contract is closed.

Unfortunately many people do not realize that the job of building a house, as far as the prospective owner is concerned, also should be closed when the plans are approved and the building contracts are let. In such cases it costs no more to build a house than to buy one, and in addition if you build a house you get one that exactly suits your own requirements.

However, if you or your wife insist on making extensive changes in the plans after construction is started, the cost of

The L-shaped construction of the house shows clearly in this picture. The door under the porch in the angle leads into the foyer at the foot of the curving stairway. A second entrance is in the right wing

the house is bound to run above the calculated figure. My neighbor solved that problem so thoroughly that his house cost him only $40 more than estimated. He simply remained away from the job until the house was finished.

The first job in designing my own home, or any other home for that matter, is to figure out what general type of floor plan will best fit into the shape of the lot and also meet the property restrictions. Here I encountered a problem somewhat out of the ordinary.

To begin with the lot on which I wished to build was shaped like a section of pie, the straight sides measuring 116 and 160 feet. The property restriction was such that the house must not at any point approach nearer than twenty-five feet [illegible] side of the [illegible]

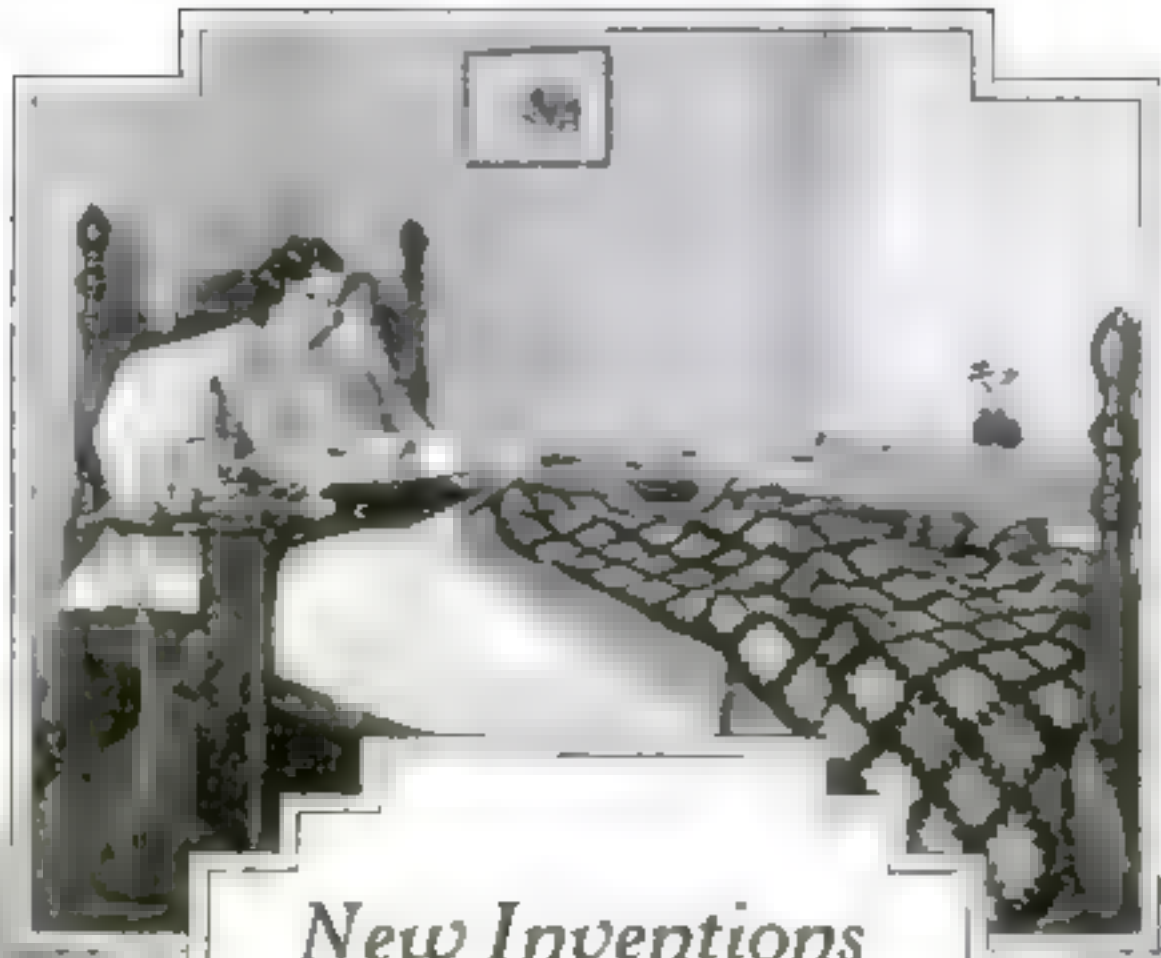
I finally decided on the L-shape arrangement shown in the plans. This gave me plenty of room to construct a house with the interior accommodations I desired.

There are, of course, many good types of house foundations and a choice between them depends on conditions in the local material market and the nature of the ground on which your house is to be built. I decided on a poured concrete foundation incorporating the walls between the different parts of the cellar and the foundation as a single solid unit.

As you will note from the plans, the [illegible] of actual excavation is small in proportion to the size of the house, and yet there is ample cellar space for the boiler room and laundry. The two-car garage is provided for on the first floor. There is no cellar excavation under it, and only sufficient excavation is done under the living [illegible] (continued on page 144)

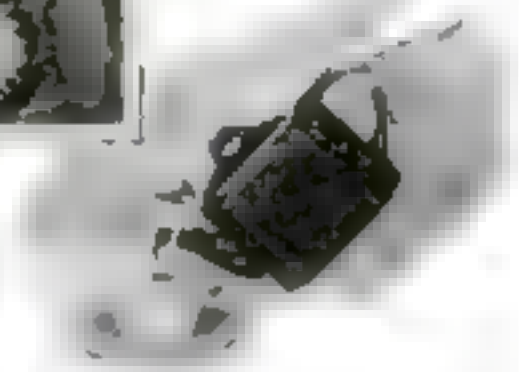
At top, looking through the well-planned kitchen into the breakfast room beyond. Note built-in electric refrigerator next built-in cabinet. Above, the living room from door leading to foyer

New Inventions Designed to Help Busy Housewife



REST FOR TEA BAG. Clipped to the edge of a saucer, the device shown below makes a convenient rest for the tea bag after the drink is brewed. Also, the rest can be used by smoker as an ash tray.

VANISHING BED TABLE. This table stands securely at the side of the bed while in use and is high enough to be convenient. Afterwards its hinged supports fold and the table rolls on casters under the bed. Folded it is compact, only a few inches high.



BIRDS PREVENT STAINS. Gay little birds clipped to the spout of the teapot are not only a decoration, but they hold pads of felt that catch drips and prevent stains on the tablecloth.

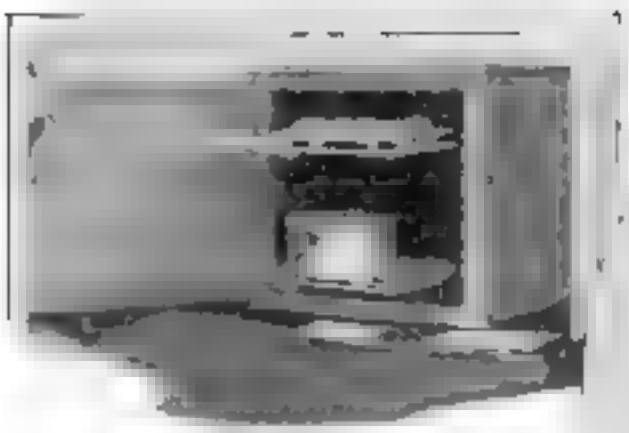
BAFFLES MILK THIEVES. Built like a letter box this new door compartment safeguards the morning milk. The bottle is shoved through the opening and drops into a rack that stands inside the house.

NEST OF STRAINERS. With strainers of various sized mesh, each fitting the same holder, anything can be strained as desired.

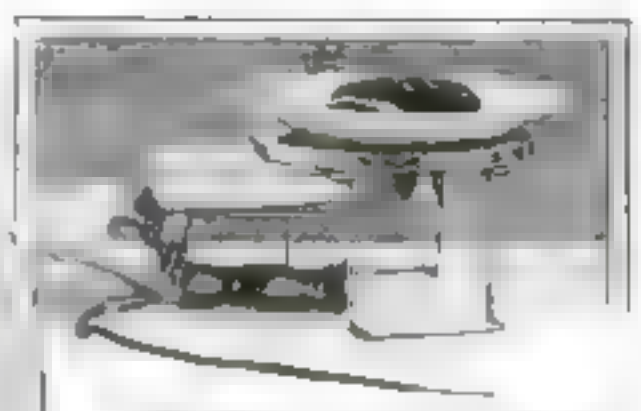
BRISTLES OF CHAMOIS. Small pieces of chamois attached to this brush form a polishing implement that is easy to hold and avoids the nuisance of handling a large piece of the skin when cleaning metal.

ELECTRIC COFFEE ROASTER. In order that you may have your coffee freshly roasted, this device for home use has just been developed. When the roaster is filled, electricity heats it and, turned by hand, the bean is roasted evenly.

SWIFT POTATO MASHER. Clamped to the edge of the kitchen table, this mechanical potato masher at one stroke of the handle mashes a cooked potato and the mealy vegetable then falls into dish.

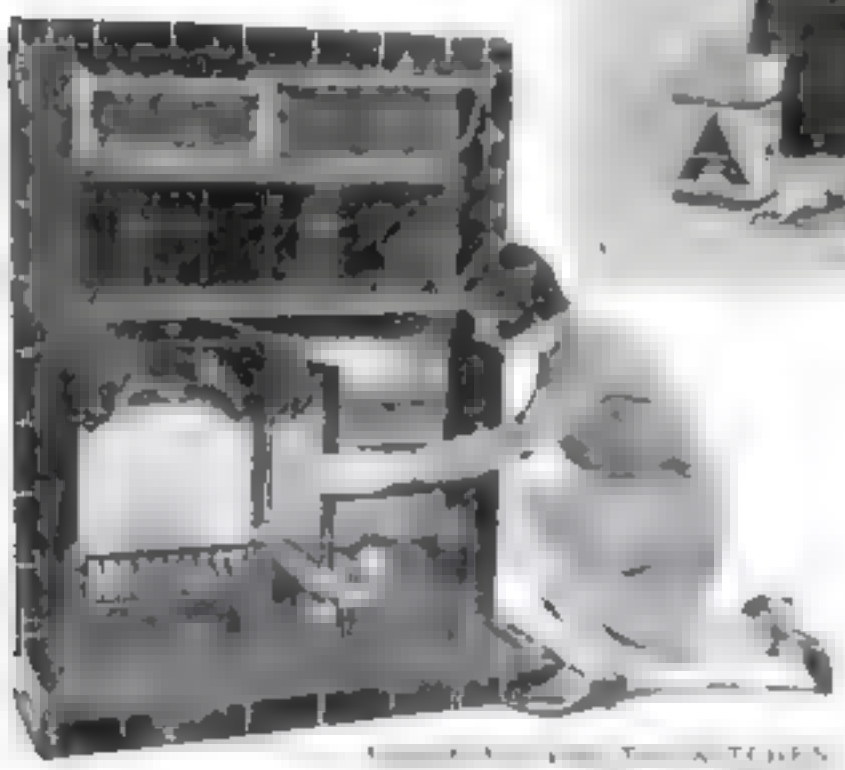


WORKING OVEN RACK. When [illegible] this [illegible]-covered oven is [illegible] ing [illegible] out [illegible] ing which ever is using it like [illegible] way [illegible] possible without [illegible] ing hand [illegible] on [illegible] ing inside [illegible]



NEW USE FOR ELECTRIC IRON
[illegible]

PUTS CAP BACK ON BOTTLE
When you want to reseal a bottle [illegible]



Here is a new combination which puts together a cookstove and a fireplace. The heat that ordinarily goes up the chimney from a fireplace is utilized to do the cooking in the stove. The open fire adds an all active touch to the ordinary properly equipped kitchen

FIRE SCREEN ROLLS UP. It is unnecessary to move this screen aside when you want to get at the fire. A tug on the handle rolls it up like the shade at a window. When pulled down again it serves its purpose of guarding against sparks.

COVER FITS ANY POT. This perforated cover, with a hole in its center, converts any pot into a double boiler. It also serves to warm plates. Adjustable fingers fit over rim of pot of boiling water.

TABLE OR STOVE. This new gas range can be transformed in a minute into a kitchen table. Across the space occupied by the burners slides a porcelain plate, and abundant working space is thus instantly available. In addition the stove provides a large cupboard in which supplies may be stored, saving steps.

DEFIES THE MOTHS. These drums of strong fiber board are moth proof and can be used to store furs, blankets, and woolen clothing. Top and bottom, of japanned steel, lock in place.

Popular Science MONTHLY

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Published Monthly by Popular Science Publishing Company, Inc 381 Fourth Avenue New York City Single Copies Twenty-five Cents In the United States and Its Possessions and in Canada, $2 50 the Year In All Other Countries $3 00 the Year

He Will Not See

AN EMINENT clergyman, speaking before an educational conference recently, declared that "the people of America are lacking in social intelligence. We are too mechanical. What we need is more of the human touch." He enlarged on this theme in a scathing denunciation of modern science, modern machinery, and modern methods.

Such talk gives us a severe pain in the neck. Does the reverend doctor really believe we have lost the human touch and become too mechanical because we no longer have to labor from dawn till dark for the bare necessities of life as our forefathers did? Does he believe the human touch is missing because we have good light to read by at night instead of ruining our eyes under a dripping candle as they did in the dear departed days?

Does he feel that we are becoming too mechanical because our homes are now adequately heated and we no longer have to go to bed to keep warm? Is he sure that we are being dehumanized by the varied food supply science has made available throughout the year? Does he want us to go back to the vegetableless winter diet of our ancestors?

Would he relish wading in ankle deep mud and making only two trips to town each year as was the common lot of many a farmer before science gave us good roads and automobiles to drive on them? Can the reverend gentleman point to anything in the past that ever brought such an intimate, personal, human touch into the home as has the radio?

In short, does this clergyman really want to go back to the days when pestilence decimated the population at frequent intervals because there was no modern scientific medical knowledge —to the days when people were bled for almost every disease and the only anesthesia was a stiff drink of whisky or a crack on the head?

Truly, there are none so blind as those who will not see!

Science Needs Amateurs

WE GOT a real thrill out of the article on page fifty-six describing an amateur's marvelous success in compounding and using "plant pills" in his home garden. Possibly this article will prove tantalizing to many readers because it tells so much and reveals so little but we are entirely sympathetic with Mr. Patterson in his refusal to divulge his formulas. He has made what may prove a discovery of great commercial value. He made it independently and through his own efforts. If any rewards are to come from it, they are his; and he is well within his rights in protecting the secret of his "pills."

What Mr. Patterson has done should supply inspiration to other readers of this magazine. He has demonstrated that the key to the secret of "plant pills" is written in language anyone can understand in books that are available in any public library He has proved conclusively that an ordinary layman, without special training or special knowledge, can perform important scientific work—if he will devote to the task the effort and the time necessary.

There is nothing that we can see to prevent any other reader from doing exactly what Mr. Patterson has done, not only in the field of horticulture but in the hundred and one other branches of science that are discussed every month in POPULAR SCIENCE MONTHLY. For Mr. Patterson not only demonstrates that the important work still to be done in science need not be left to the college professor and professional research man, but presents a method of procedure that can be expressed in three words: Think. Study. Work.

Fighting by Proxy

WARFARE in ancient times, when husky gentlemen walloped each other with maces, broadswords, and the like, had some element of glamour and romance. It appealed to the combative instinct rooted deep in the human brain.

That same urge to take part in or witness a personal combat is, of course, responsible for the popularity of all modern sports ranging from boxing through football to tennis or golf.

Modern warfare, while replete with individual acts of bravery, is in the main, almost totally lacking in the glamour and romance of ancient conflict. How can you feel a thrill along the combative nerves in a war where you virtually never see the enemy?

This business of divesting warfare of every vestige of personal combat is going on apace. The article on airplane carriers on page thirty-six is an indication of what is happening. Such vessels might, conceivably, attack an opposing fleet when the latter was still far beyond the curve of the horizon. The individual aviators would get a thrill out of it but the crew of the ship might just as well be home listening to the radio.

The next logical development is robot control of the individual planes which would eliminate the aviators. After that, naturally, would follow robot management of the airplane carrier itself. With complete remote control of each individual fighting machine and plenty of robot soldiers to dig trenches and wallow in the mud of land operations, modern warfare may even become a game, played on an electrical control board!

Hard on the Patient

ATTEMPTING to attain perfect health by the aid of some queer fad occupies the attention of countless numbers of people. It is fortunate, therefore, that a large number of health fads, unless carried to ridiculous extremes, are virtually harmless

There was, for example, the recent craze for orange juice. Overzealous faddists claimed that a diet of virtually nothing but orange juice would cure nearly every bodily ill. It died out after awhile because the orange juice swiggers found they were starving to death.

Now the orange is one of our most valuable fruits. Aside from its delicious flavor, it has a proven ability to correct overacidity of the digestive system. It is, therefore, quite logical to include a liberal amount of orange juice in the diet of a person inclined toward acidosis. But that doesn't make it a cure-all.

The same silly exaggeration of the importance of other dietary and medical treatment ideas has, at times, afflicted even the members of the medical profession, who should know better.

There was a time when it was quite the thing to chop out a person's appendix whether or not the doctor knew the real cause of his illness. Many perfectly sound and normal appendices were removed that never should have been touched

According to Dr Billings professor emeritus at the University of Chicago, the same thing is now happening to people's teeth and tonsils.

Speaking before the New York Academy of Medicine recently, Dr Billings said "I regret to say that too often, through superficial examination, failure to apply rational principles, and poor judgment, a patient's teeth or tonsils are needlessly sacrificed."

All of which proves that doctors are merely human, like the rest of us. The only difference is that when we follow a health fad, we, ourselves, suffer. When the doctor does it, we get it in the neck—or rather the tonsils.

Midget Sets at Low Cost
New Trend in Radio

By JOHN CARR

JUST when everyone was beginning to believe that radio sets had about reached perfection and no major improvements or changes might be expected, along came a new idea. This time it was the so-called mantelpiece or clock type radio. Hundreds of thousands of these midget sets will be made and sold this season.

In one way this new development is unique. All former major changes in radio receivers have been made with improved operating characteristics as the objective. The new small sets, on the contrary, have been designed with size and low selling price as the chief considerations. As a class they are not equal to their larger brothers for sensitiveness, selectivity, or tone quality.

Fortunately however, the sacrifices that have been made in these qualities are not great.

The sensitiveness of a radio receiver governs both its ability to bring in distant stations under normal conditions and its ability to bring in the weaker local stations when conditions are exceptionally unfavorable. In sensitiveness, the new mantelpiece or clock type radios are about

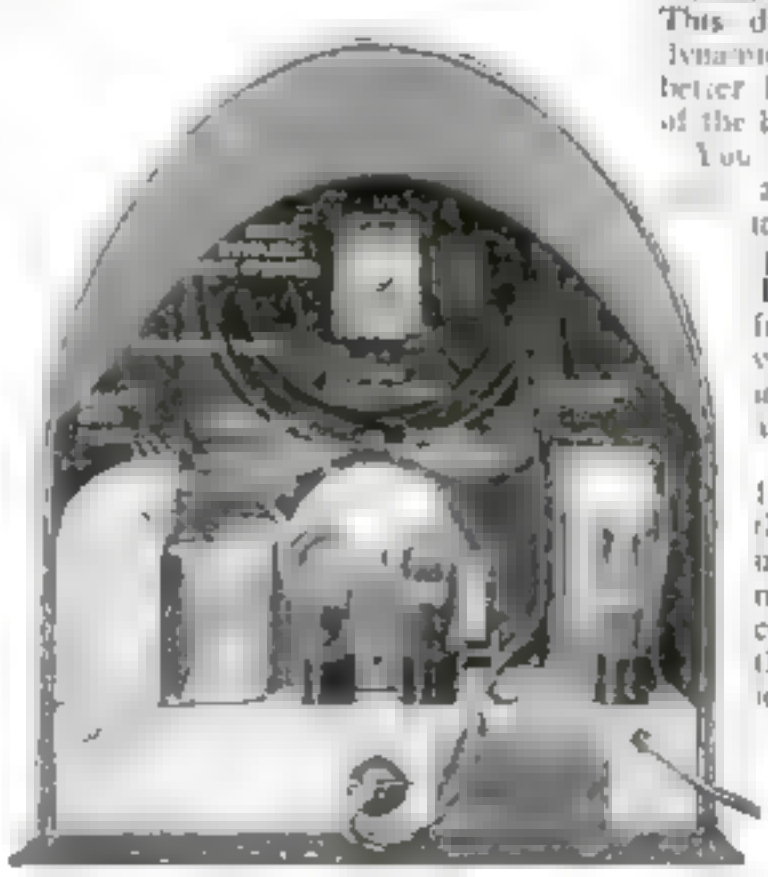


Fig. 1. All of the parts of the mantelpiece radio set are indicated in this drawing, showing what careful designing was necessary on the part of the engineers to get them into so small a space without interference

[illegible] ar with the best of the receivers [illegible] couple of years ago. Under [illegible] conditions they will, therefore, [illegible] n stations as well as could be [illegible]

[illegible] his coun- [illegible] sets have a greater degree [illegible] Unless built of any practical use except where he must [illegible]

AS LONG as the Federal Radio Commission allows as many stations to broadcast as are now on the air nightly, resulting in hash over large portions of the dial, the new small sets will bring in [illegible]

The selectivity of a radio receiver which governs its ability to choose between stations on adjacent waves, is closely associated with its sensitiveness. The more sensitive the receiver the more selective it can be made. The sensitiveness of the clock type radio being lower the selectivity also is less, but not to a serious degree.

The tone quality of the new sets is only slightly inferior to the larger models. This difference is due to the smaller dynamic cones used and to the lack of better baffling provided by the cabinets of the larger sets.

You will wonder how it is possible to [illegible] a complete radio receiving set, including power supply and loudspeaker, into such a small space. The answer of course lies in careful designing. The location of the various component parts of a typical modern small set is indicated by arrows in the illustration in Fig. 1.

The power transformer takes the 110-volt alternating current from the light socket and transforms it into high voltage current. After rectification in the rectifier tube, the current is filtered and passed through the field coil of the dynamic loudspeaker to energize it and then becomes the B supply for the set. The power transformer also has other windings, which step down the 110-volt current to low voltages suitable for operating the filaments of the various tubes.

Considering the relatively small (Continued on page 143)

New Radio Battery Lives on Air

Carbon electrode pores, absorbing oxygen and transferring it to surface in solution so water is formed, lengthens the life of the cell and gives it uniform strength.

By ALFRED P. LANE

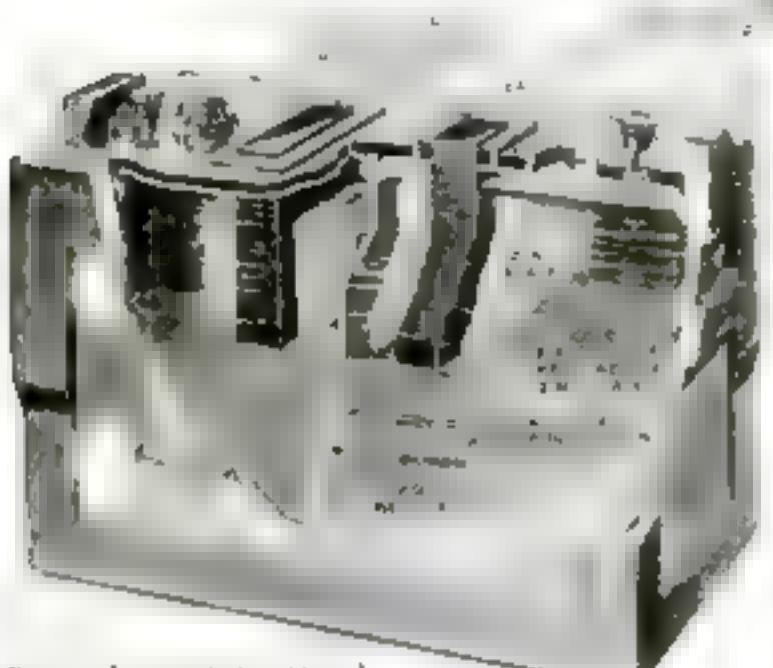


Fig. 1 shows what new cell looks like. Note big carbon electrode with top exposed.

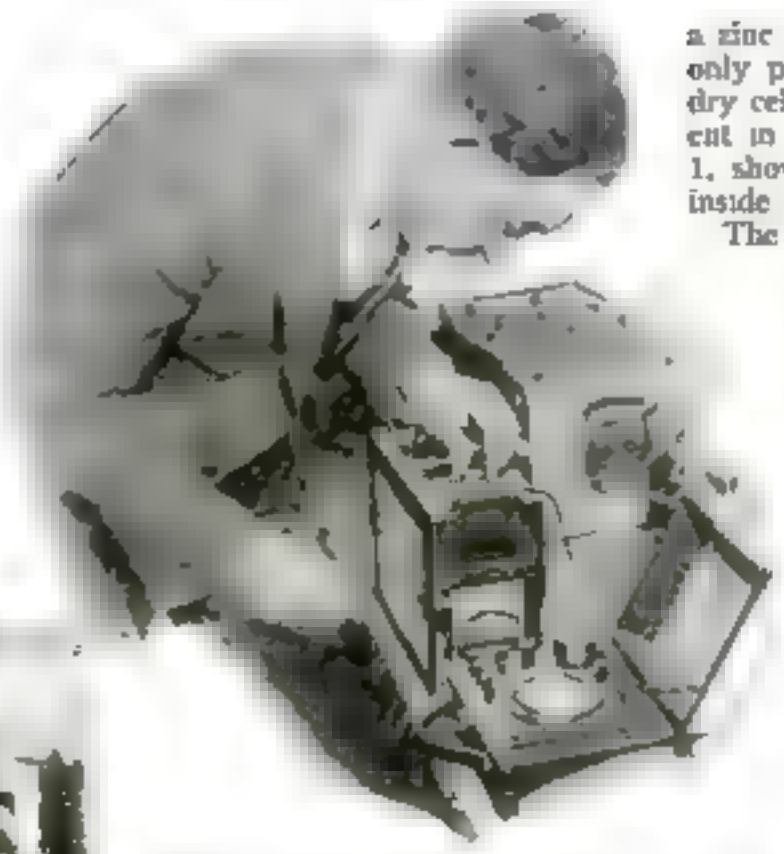


Fig. 2. New cell with carbon electrode is being tested in Popular Science Institute laboratory.

A BATTERY that has carbon lungs capable of breathing air like the lungs of a human being is the most sensational development which has taken place in battery construction since the development of the first dry cell.

This new battery, when used to operate sets fitted with the new tubes types 230, 231, and 232 (P. S. M., Oct. '30, p. 72), completes the solution of the farm radio problem. The farmer and isolated home owner with no fuss or bother about batteries can now get radio service virtually equaling that of the city man.

These developments were brought about by the inherent disadvantages of the old style tubes and the dry batteries used to operate them.

The old 199 and 120 dry cell tubes could not stand any overload. The filaments were so frail that operation at even a slight excess in voltage soon ruined them. And the situation was made still worse by the characteristics of the ordinary dry cells which were the only practical source of current for these tubes.

The standard dry cell, when new, develops nearly 1.6 volts. This voltage steadily drops off with use until the serviceable life of the cell ends at about 1.1 volts. The voltage variation of the ordinary dry cell is, therefore, nearly one third during its useful life.

It was possible, of course, to get satisfactory results out of such a combination if the radio receiver was fitted with a voltmeter and the owner watched the needle like a hawk and kept it constantly at the right voltage. Most radio users didn't bother to give the filament voltage such close attention and poor tube life was the result.

The new tubes, types 230, 231, and 232, while they are more durable and consume less filament power than their predecessors, will not give best results if they are operated on excess filament voltage.

The ordinary dry battery consists of a cylindrical container of zinc inside of which is a layer or two of blotting paper soaked in a solution of sal ammoniac. Inside that is a mixture of powdered manganese dioxide which surrounds the carbon electrode in the center of the cell. Sealing wax is used to make the cell air-tight so that it will be dry on the outside and retain the necessary moisture inside.

When the zinc shell, which forms one electrode, and the carbon electrode are connected into a circuit permitting the flow of electric current, the sal ammoniac attacks and slowly dissolves the zinc shell. This chemical reaction supplies the energy for the electric current. At the same time hydrogen gas is liberated at the carbon electrode and forms an insulating layer that stops the flow of current.

THE function of the manganese dioxide is to supply oxygen which will combine with the hydrogen, form water, and thus destroy the insulating layer of hydrogen gas. It does this reasonably well until the chemical action slows down and the voltage developed by the cell becomes less and less.

The new air cell battery depends for its electrochemical energy on a reaction with a zinc electrode, but that is almost its only point of resemblance to the old dry cell. Physically it is totally different in appearance. The diagram, Fig. 1, shows what the air cell looks like inside and out.

The container is an inexpensive molded composition. The solution is sodium hydroxide. The zinc is in the form of heavy electrodes suspended in the solution.

The other electrode is carbon and in this electrode is the secret of the operation of the battery. It is a special form of carbon that has the property of taking oxygen out of the air, transferring it to the surfaces exposed to the solution, and thus automatically forming water out of the oxygen layer as fast as it is deposited.

Note how much of the surface of the electrode is exposed to the air. The oxygen is actually absorbed by this surface. For example, if you were to cover it with paint or a layer of wax, the cell would soon smother and die just as you would if the air supply to your lungs were shut off.

The two-cell unit battery has a capacity of 600 ampere hours, which means that it will run a seven-tube two-volt set three hours a day for a whole year. The same result with ordinary dry cells would require $18 worth of cells plus the trouble of replacing them and watching the voltage all the time.

THE new air cell battery costs less than half that amount, and what is still more important, it develops so uniform a voltage throughout its entire useful life that no rheostat adjustment is necessary. All that is required is a fixed resistance to cut the battery voltage to the proper point for the number of tubes you are using.

The resistance is, therefore, actually a part of the circuit and the set requires no attention so far as the filament circuit is concerned except to turn it on or off just as is the case with electric sets operating from the light socket.

The working voltage of the battery is 2.53 volts. This voltage should be reduced to 2.2 volts at the tube socket filament terminals. To determine the proper fixed resistance, figure out the total current used by all of the tubes by adding up the current needed by each one. Divide 33 by the figure representing the current consumption and the result is the value of the fixed resistance in ohms.

For example, a seven-tube set which includes two type 231 power tubes in a push pull circuit takes .55 amperes. Dividing 55 into 33 gives 6 ohms. For a single tube set using one 230 tube, the current consumption would be .06 amperes and the value of the necessary fixed resistance would be 5.5 ohms.

If you are adapting an old set for use with the new tubes and the new air cell battery, it is *(Continued on page 143)*

Novel Way to Find Any Station on Air

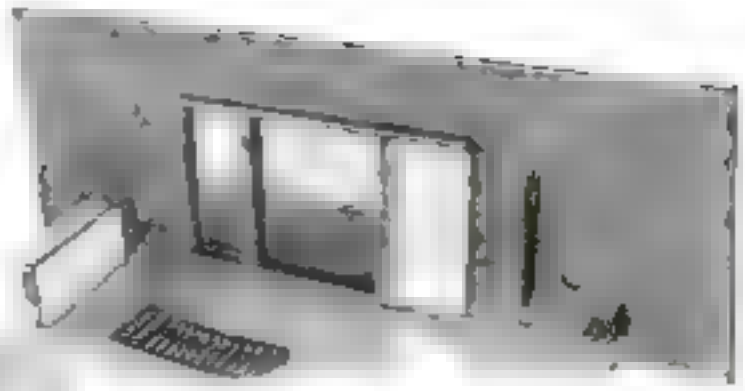


Fig 3. Panels in which list reproduced on film is to be placed as shown in picture at left below

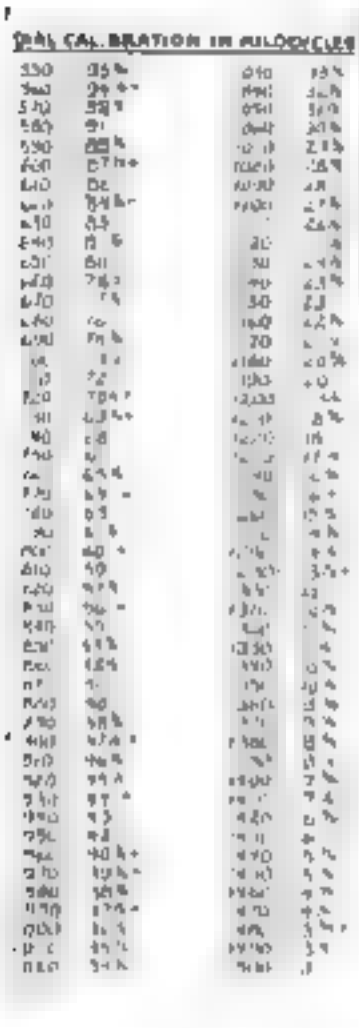
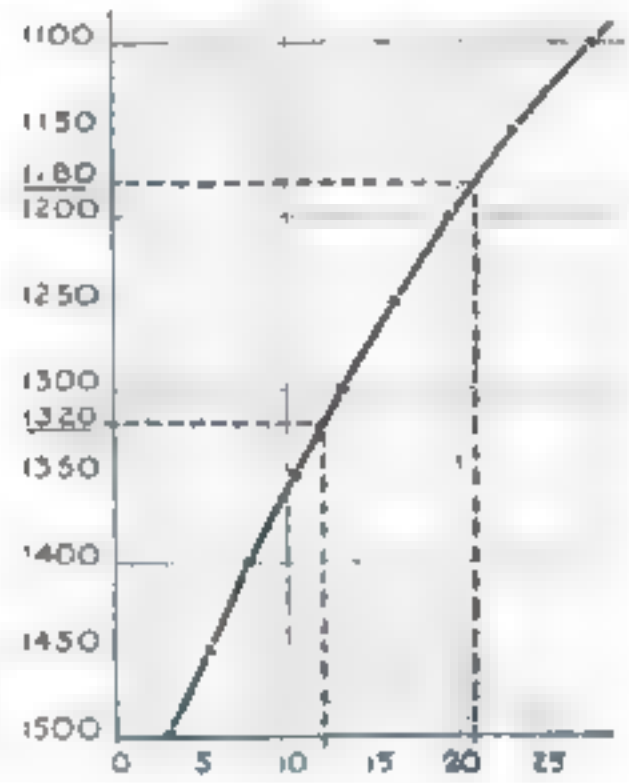


Fig 1 How your table of frequencies should be arranged so you can find any station you desire.

Fig 2 On cross section paper shown at right plot frequencies and dial settings of stations you have listed Curved line will give locations of other stations if your tuning has been accurate



How to Locate with Pencil and Paper the Dial Setting That Will Bring in Program You Want

IF YOU are like most radio fans, you spend a lot of time, after you get a new receiver, trying to find the dial settings for the various local and distant stations you want to hear. The scrap of paper on which you have noted these magic numbers really is a most important part of your radio receiving equipment.

How would you like to be able to turn the dial instantly to the proper setting for any broadcasting station in the country whether you have ever heard it before or not? All you need is a table that shows the dial setting opposite each of the ninety-six frequencies used by the hundreds of different broadcasting stations. You can prepare such a list yourself. The only equipment you need is some cross section paper, a pencil, and a little patience

Cross section paper is sold by almost every stationery store. Get the type that is ruled with ten divisions to the inch Check over the list of stations for which you have the dial settings. Probably you have found stations scattered here and there all along the dial.

If there are any gaps of over ten divisions on the dial where you have not located any stations, spend a night or two finding stations to fill these "blind spots." It makes no difference what stations you locate so long as you tune them as accurately as possible.

The frequencies used by the local stations can, of course, be obtained from the radio program of the daily paper. You will have to purchase a call book to obtain the frequencies of distant stations.

Look over the diagram of Fig 2 and you will see how you are to plot on the cross section paper the frequencies and dial settings of the stations you have listed. For example, suppose you have heard a 1,500-kilocycle station at three degrees on the dial The pencil dot should be on the base line representing 1,500 kilocycles at a point three divisions from zero

If you have accurately tuned the various stations, you will find that it will be possible to draw a smoothly curved line that will include virtually all of the dots. Draw this curve. Then you can prepare a table such as is shown in Fig. 1

THERE are ninety-six frequencies used by the broadcasting stations, and you can find the proper dial setting for each one of these frequencies by finding the corresponding point on the curve you have drawn.

Figure 2 shows how to do this. The round dots represent the stations you have heard. To find the stations between, follow the horizontal line representing the frequency to the curve and the dial reading will be directly below

You will find such a table a big aid in bringing in distant stations and in identifying those you do hear

Figure 3 shows a novel way to fit the tuning information list so that it will be handy for use. Instead of writing the figures on a small card that is easily lost, take a photograph of the list on a film, or write the list on a piece of tracing paper and print it on a film. After development, the film will show negative; that is, white letters on a dark field. By fitting a false panel on the set, you can find room for a couple of flashlight bulbs placed as shown in Fig 3.

A PIECE of white paper, properly curved, will act as a reflector and the numbers will stand out in white light against a dark background when the film is placed in the panel in front of the reflector. If you use two panels one should give a list of local stations and the other the calibration for all frequencies.

A novel feature of this arrangement is that there is no sign of any list when the lights are out and you avoid the poor appearance of paper lists stuck on the front of the set

The same idea can be applied in many ways, even to building a small cabinet on top of the radio set with panels to contain the film negatives of the tuning information.

Latest Transmission Tricks—What They Do for You

Gus Tells You Exactly How Free-Wheeling, Silent Second, and Synchro-mesh Work in Car

By MARTIN BUNN

"AARRK! Go slower! Go slower!" the big green parrot croaked Professor Donaldson, who knew a lot about literature but very little about cars, glanced angrily at the bird as it sat solemnly swaying in its cage in the back of his automobile.

"You've said that so often even the bird is imitating you, Matilda," he protested to his wife.

At that moment the car rounded a curve and Donaldson smiled in anticipation as they approached the top of a long down grade.

"Here is a chance to try out free-wheeling," he whispered to himself as he threw the gear lever into neutral, took his foot off the clutch pedal and settled back to enjoy the smooth floating sensation. He did not notice that the motor accidentally stalled owing to an exceptionally close idling adjustment.

The car attained sufficient speed to coast a considerable distance along the level stretch at the foot of the hill and then, as it slowed down, the professor attempted to shift into gear. There was a terrific clashing, but the gears would not mesh. He pressed the clutch pedal clear down to the floor boards and tried again with no better result.

By this time Professor Donaldson was so flustered that he did not notice that he was coasting into the rear of a car ahead that had stopped at a traffic light.

There was a clang, followed by a squawk from the parrot, a shriek from Matilda and a grunt from the professor, who had been forcibly propelled against the steering wheel.

A grizzled head poked out of the window on the driver's side of the car the professor had bumped and a dapper little chap with large glasses popped out of the other side.

"Nothing busted, Gus," the latter reported after inspecting the damage. "Our car's all right. This boob's bumper fell off, that's all."

"I'd better take a look," the other grumbled as he, too, got out and looked things over.

"You can't run with your bumper that way, mister," he observed to the professor who had not yet recovered his breath. "Want us to fix it for you?"

Professor Donaldson looked at him wonderingly. "Most amazing!" he exclaimed. "I run into you and you offer to fix my car for me!"

"Nothing generous about it," said Gus. "You're going to pay for the work if you want us to do it. My name's Wilson. This is my partner, Joe Clark. We run the Model Garage in the next town."

"Excellent!" said the professor, beaming. "Fasten it temporarily and I'll follow you to your shop."

"WELL, mister," said Gus as the two cars drew up in front of the Model Garage a little later, "I'm kind of curious to know how you happened to slam into us that way in broad daylight."

The professor grinned sheepishly. "I was attempting to free-wheel down that hill and I was unable to operate the gear lever when we reached the bottom."

"Free-wheel?" repeated Gus in puzzlement. "Oh, I see. You were coasting in neutral, and the motor stalled. That's why you couldn't get into gear again. That's coasting, not free-wheeling."

"Isn't it?" exclaimed the professor. "I thought free-wheeling was merely disengaging the gears so the wheels could turn freely. I'm afraid I fail to grasp the meaning of many of the terms used to describe transmission features. What, for example, does 'synchro-mesh' mean? Or 'silent second?' Could you explain what those terms actually mean in ordinary language?"

"I can try," Gus smiled as he squinted along the bumper to see if he had succeeded in removing the kink.

"Did you ever ride a bike, one with a coaster brake?" the veteran auto mechanic asked.

"I SHOULD say so!" replied Donaldson. "But what has that to do with free-wheeling?"

"A whole lot," Gus stated. "Free-wheeling is really going back to the old bicycle days. Your legs could make the wheel go round but when you got tired pedaling or you wanted to coast down a hill you just stopped your feet. As quick as a wink the mechanism in the rear wheel disconnected the back sprocket so the motion of the wheel couldn't make your feet go round.

"Free-wheeling really is as old as the hills," Gus continued. "A free-wheeling auto is just like any other auto with one extra gadget added. That gadget is a one-way clutch, not a whole lot different from the coaster brakes they've been fitting to bikes for thirty years or more. And a one-way clutch, which is what a coaster brake really is, has been used in various machine applications for a great many more years than that.

"The winding stem of your watch, for instance, is one of the oldest types. It uses a ratchet that slips over the teeth one way for the free motion and hooks into them to wind the spring when you turn it the other way. The film-winding key on a camera has the same kind of mechanism to prevent the key from turning the wrong way.

"The trouble with the ratchet arrangement is that it *(Continued on page 133)*

BETTER SHOP METHODS
NEW IDEAS FOR THE HANDY MAN
HOME WORKSHOP CHEMISTRY
BLUEPRINTS
MODEL MAKING
SHIPSHAPE HOME

THE HOME WORKSHOP

Electric Flowers for Your Table

By
WALTER E. BURTON

IF YOU are planning a dinner party or wish to do something particularly novel to decorate the Christmas table, why not try the electric light plant?

No, the plants in this case are not power stations—and no pun is intended. They consist of crêpe paper flowers which have their own lighting equipment. With one of these flowers glowing near each plate, no other lights need be employed on the dinner table, at least at the beginning of the meal.

All you need for constructing an illuminated flower is a single flashlight battery cell, a 1.2-volt lamp to go with it, a little paper and glue for the flower itself, and a bit of bare copper wire. You frequently can purchase suitable paper flowers ready-made

Wrap the wire around the grooves in the flashlight bulb base as shown and bend the projecting end so that, when it is inserted between the paper cover and zinc case of the cell, the bulb will be held with its center contact touching the center battery terminal. In this position the lamp will burn for several hours before the cell is exhausted. The lamp can be turned off by unscrewing it a little or by swinging it to one side so as to break contact with the center battery terminal.

Cover the battery with crêpe paper assemble the flower about the top, with the lamp in the center, and the favor is complete. The cost will be somewhat less than 25 cents, depending upon how elaborate the flower is. That the idea is as practical as it is novel can be judged by the fact that it was first developed by L. C. Porter, of Cleveland, a research lighting engineer for one of the largest electrical companies.

In addition to table favors, the lamp-and-battery-cell combination can be used for other decorative stunts. For example, by running two fine wires around the stem of a real tulip or other large, hollow-center flower, and placing the tiny lamp inside the petals, a novel effect can be obtained. Heat from the bulb will not affect the flower greatly, at least not for several hours. The same principle can be applied to imitation or real flower centerpieces (see illustration above). The small flashlight batteries can be easily hidden in the flower holder or vase.

If you are unable to obtain a 1.2-volt lamp readily, you can use the 2.5-volt size with a two-cell flashlight battery that is intended for small size flashlights.

There are many novel uses for small electric light bulbs. Another ingenious application that should be of particular interest to the home owner is described and illustrated on page 96 of this issue

As favors, the blossoms make ideal table decorations. Centerpieces also can be electrified

The completed electric flower, and the parts unassembled to show the simple construction.

The end of the wire socket is inserted between the paper cover and the zinc shell.

Building Model Railway Signal Lights

Full automatic control on your model railway will allow you to operate two or more trains on the same circuit of track.

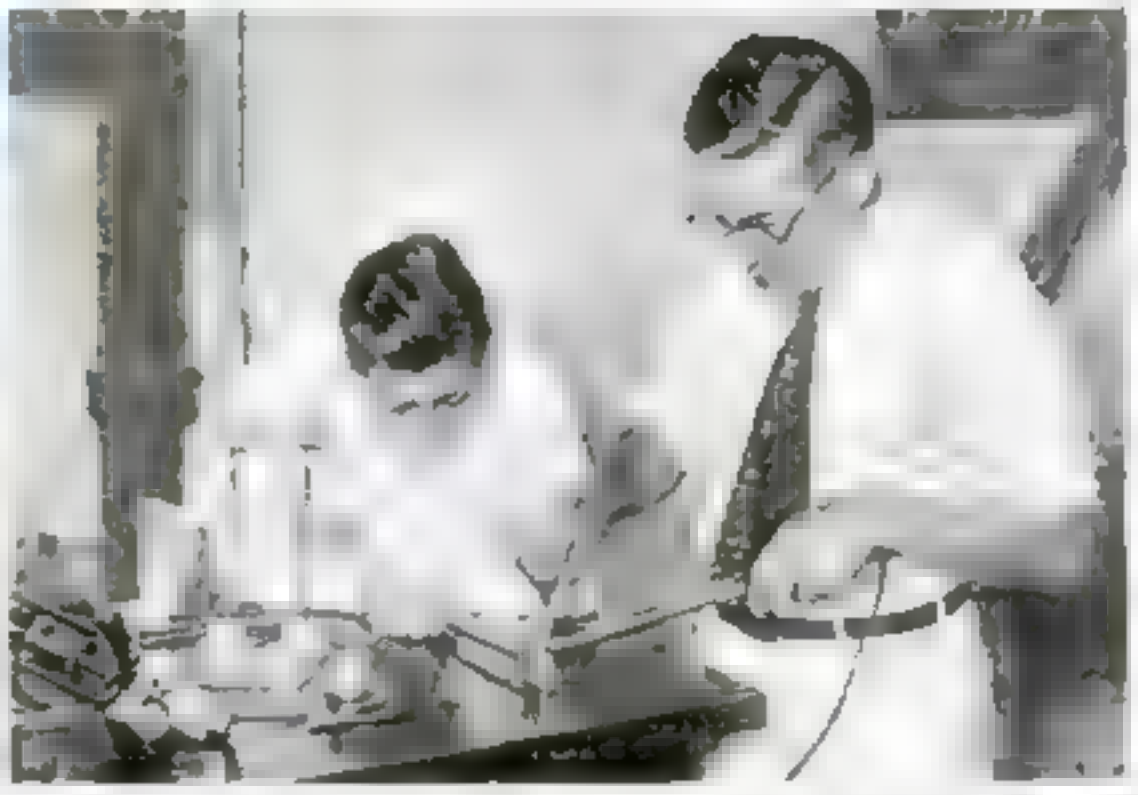


Fig. 1. Soldering one of the light shields in place. Tin from a cracker box, brass tubing, wire, and a few scraps of wood are all the materials needed in building these lights

Realistic and easily constructed equipment for use with a fully automatic block system

By FREDERICK D. RYDER

THE problems to be met in building an automatic block signal system on a model railroad were discussed last month (P. S. M. Dec. '30, p. 94), and the construction of the special switch needed to control each block was described in detail. Now we shall show how to build simple yet realistic block signal lights and how to make the special track contacts.

While they are not absolutely necessary to the operation of the system, the red and green block signal lights add the finishing touch of realism.

It is desirable to build the block signal lights to the same general scale of dimensions as that employed for the other accessories. There is, however, one limiting factor—the size of the electric bulbs which must be fitted inside the signal light housing. The standard bulbs now sold for model railroads have a diameter of a trifle over ⅜ in. and a length, including the base, of about 1 in.

The block signal lights, however, are scenery and you may therefore make any changes in the design or size that appeal to you or may be necessary to keep them in scale.

To build the red and green block signal lights shown in Fig. 2 you need a supply of light tinned sheet iron. The material of which some cracker boxes are made is just about right. Of course, thin sheet brass or copper can be used.

For the standards which support the lamp housings use ⅛-in. brass tubing. The simple bases shown are two blocks of wood nailed together.

The backs of the lights which carry the sockets for the bulbs are made from a scrap piece of bakelite. Hardwood can be used if desired. You also need a few No. 6-32 brass machine screws and some double cotton covered or double silk covered magnet wire.

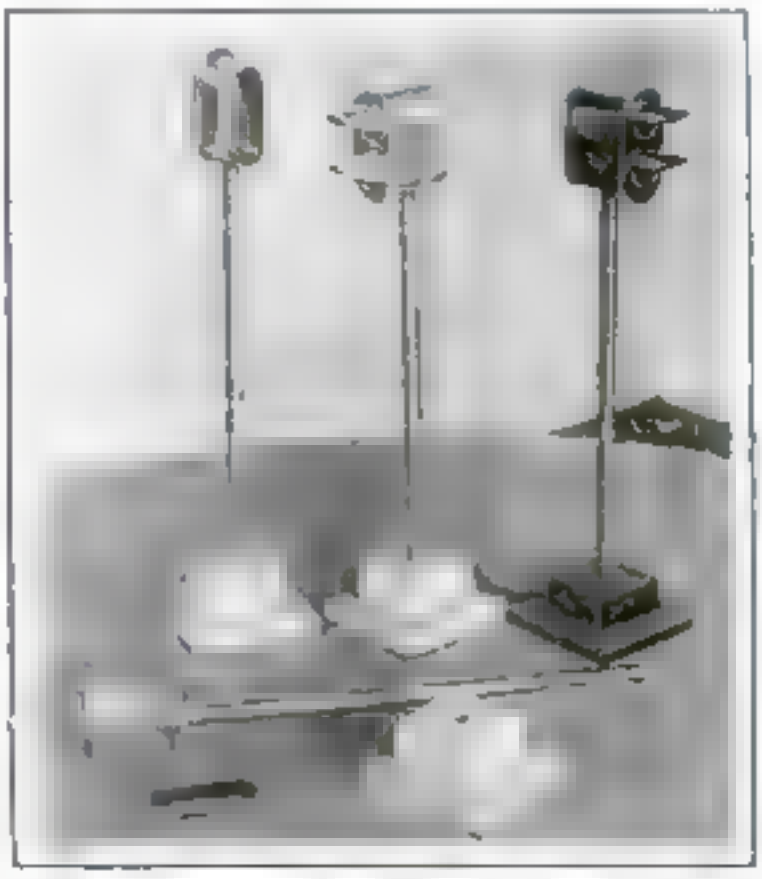


Fig. 2. A completed signal light (*at extreme right*) and three others in the process of being assembled.

Assuming that you have these materials on hand, the first job in making signals for a standard gage railroad is to cut a strip 1 7/16 in. wide and 4½ in. long from the cracker box. Bend this to form the lamp housing, which should be ¾ in. wide and 1⅝ in. from top to bottom as at *A*, Fig. 6. You will find that you can form the housing by bending the tin over your fingers or an 11/16-in. drill or dowel rod.

Solder the seam in the housing, then cut the front plate to the dimensions of *B*. Solder it on to the lamp housing and drill the two ½-in. holes.

The hoods over the holes are made by cutting out an oval of tin measuring 1 by 1¾ in. as at *C* and

D Cut the oval in two across the center, as indicated, and bend each half over a ⅞-in. drill or dowel rod to form the hoods *C* and *D*.

Next, drill a ½-in. hole in the bottom of the lamp housing and with a round file cut a groove across the end of a piece of the brass tubing so that it will match the curve of the housing. Solder the tubing in place.

Now lay the housing, back down, on a piece of bakelite and, using a sharp point, scratch the outline of the back opening on the bakelite. Work from the inside by way of the hole in the front. Jig saw out the bakelite back and touch it up with a file until it fits.

If you examine the close-up photo of the socket construction in Fig. 5, you will note that the two light bulb sockets are formed from a single piece of radio bus wire. Wind the wire around a light bulb base to form it. The slight spring in the wire will automatically give you the right clearance. Be sure to wind the two sockets so that the bulbs screw in in the right direction when the portion of the wire which diagonally joins the two coils is at the bottom against the bakelite back plate.

THE centers of the sockets should be spaced to match the holes in the front plate *B*. When you have the sockets right hold them in the position shown in Fig. 5 and mark the back plate for four holes, one at the center of each socket and the other two about ½ in. apart under the diagonal joining wire.

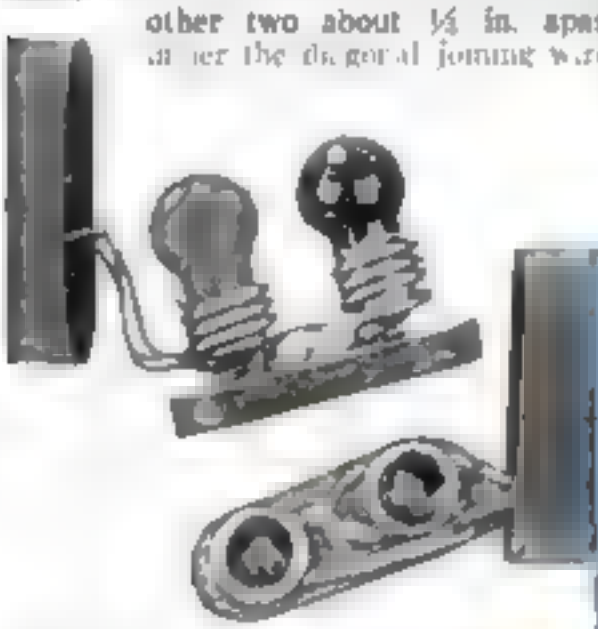


Fig. 5. Two views of the light socket assembly showing how the wire is coiled to hold the two signal lamps

Drill the four holes with a No. 37 drill and tap for a No. 6-32 screw. Set in four brass screws and cut off the heads flush with the surface of the bakelite on both sides.

A 17-in. length of the magnet wire is soldered to each of the two screws under the socket centers. Be sure to leave smooth, round lumps of solder to serve as center contacts.

Next hold the double socket in position and solder the diagonal wire to the two remaining screws. At the same time solder in the end of a third piece of magnet wire, which will form the ground connection for the two bulbs.

Make up the wood base and drill it with a 5/16-in. twist drill; this will form a right hole for the 5/16-in. brass tubing which should be cut off 7½ in. from the light housing. A hole should be drilled through from the edge of the base to join the center hole so that the connecting wires can be pulled through it. Do not push the brass standard clear through the hole in the base; allow it to remain high enough so that it does not cover the side hole.

The last job on the lamp housing should be to fit a partition which will prevent the red light from shining through the lower hole or the green light through the upper hole. This is just a flat piece of tin the width of the inside of the lamp housing placed midway between the two holes. It should be only 1 in. long so that its rear edge will clear the socket.

Now paint all the metal work, inside and out, with a coat of black. Finish the base the same color or light gray to represent concrete if you prefer.

Take two bulbs—one in carmine red electric light bulb size—and brushing lacquer on the bulbs, paint one in lawn or grass green stain or lacquer. When the coating has dried, screw each bulb in its socket with the red at the top. The bulbs can be purchased already colored if desired.

Thread the wires down through the brass tubing and out through the hole in the base. Push the back plate into the light housing, and the job is complete. Remember that you will need as many

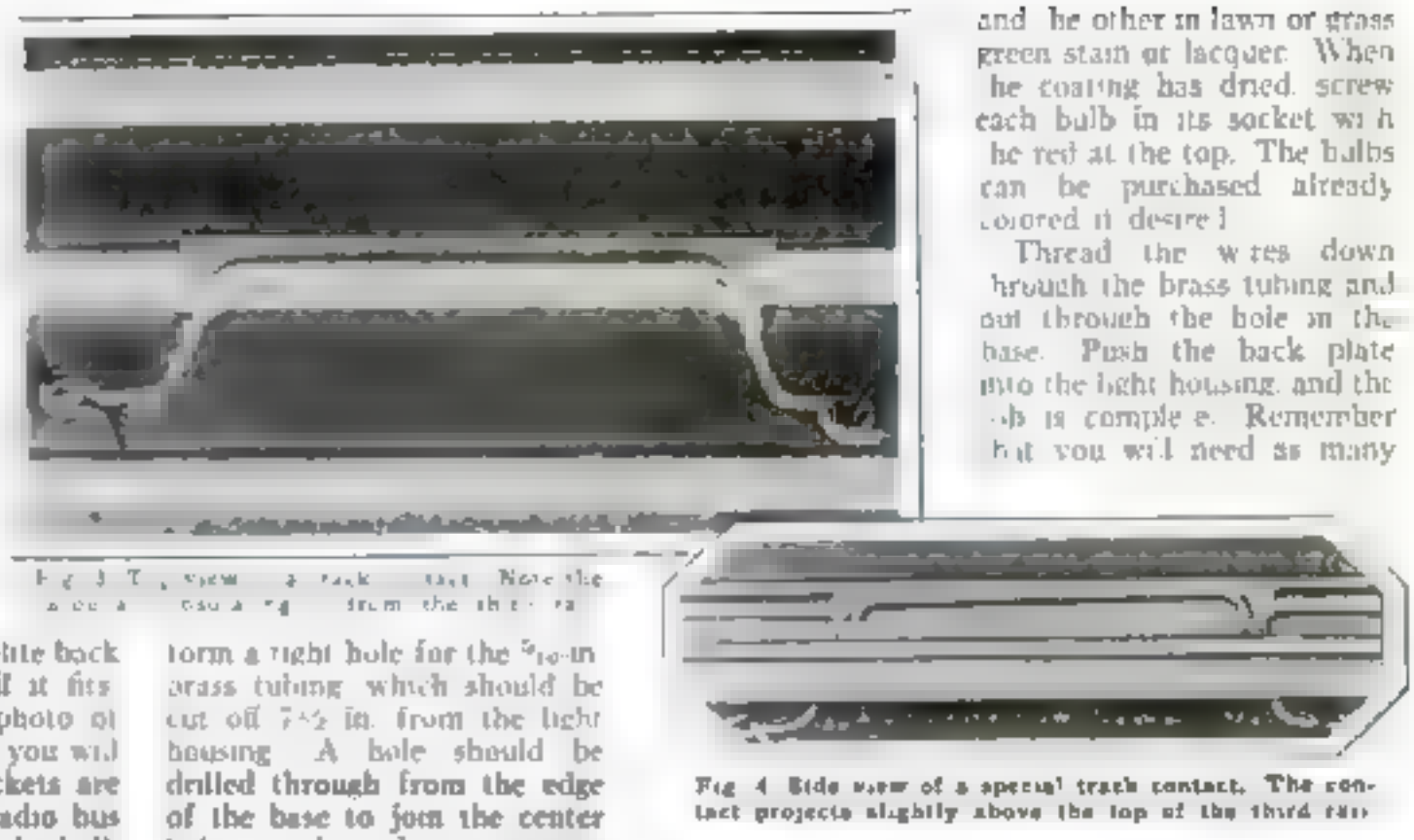


Fig. 4. Side view of a special track contact. The contact projects slightly above the top of the third rail

block signal lights as there are blocks installed on your model railroad.

The next step is to make the special track contacts. The close-up views of one of them shown in Figs. 3 and 4 indicate the construction so clearly that not much description is needed (see also Fig. 6).

EACH track contact is bent out of radio bus wire or any stiff iron or steel wire that is available. Each end of the wire is rigidly fastened by means of a round-headed wood screw that passes through a loop formed in the end of the wire. It is assumed, of course, that both the track and the track contact are fastened to the floor or table on which the model railroad is placed.

The track contact wire should be bent in such a way that when it is screwed in place it will press tightly against the third rail of the track. It should project slightly above the level of the third rail. Insulate the wire from the third rail by means of a piece of stiff cardboard slightly longer than the contact and of the shape shown in Fig. 6. Cardboard of the type used in visiting cards will do. Be sure to cut the ears in the ends in such a way that the wire contact is not allowed to touch the third rail.

Study the drawing of Fig. 6 and you will see why this particular method of construction is used. Note that current flows to the special contact by way of the roller that rests on the track beyond the contact. Only a double roller collector such as is fitted to the locomotive can, therefore, send current through the special track contact circuit. A single current collector roller such as is fitted under the passenger cars to supply the lights in the cars rolls up on the end of the cardboard and thus breaks contact with the third rail before it strikes the special track contact.

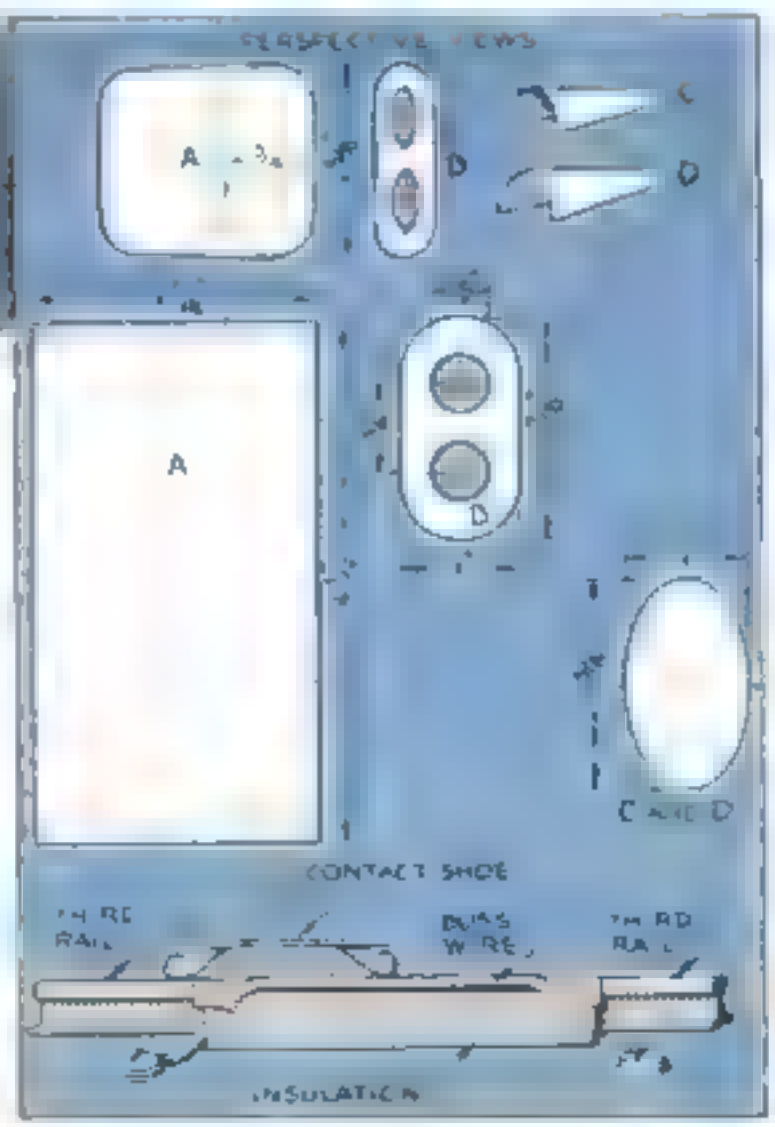
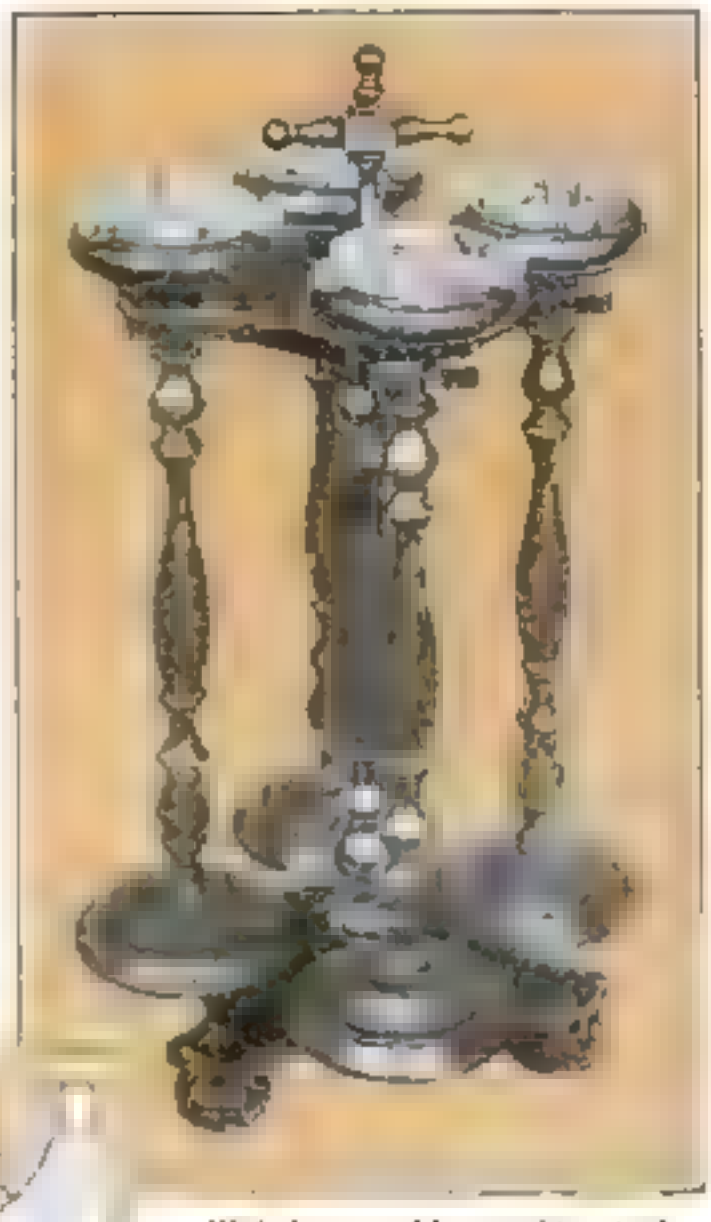


Fig. 6. Detail views of the parts that go to make up the lamp housings, and a side view of a track contact.

Next month Mr. Ryder will complete this series of articles on model railroad automatic block signal systems with full instructions for installing such a system.

A Four-in-One Nest of Smoking Stands

By JOHN M. CHITTENDEN



With this nest of four smoking stands you will never be short of ash trays

THIS novelty smoker with its four separate ash tray stands will give the wood turning enthusiast an unusual amount of practice, for it embodies twenty-one separate turnings and covers all the common forms of lathe work. Once it is made, too, it will continue to give pleasure, both because of its graceful appearance and its utility

A piece of this type really calls for a good cabinet wood. The original is of walnut throughout, but mahogany, maple, birch, or red gum would be acceptable

The pedestals, being simple examples of spindle turning, offer no difficulties, but care must be taken to follow all dimensions carefully, especially at the upper end of the four supports for the removable stands. The dimensions shown on the drawings allow these four pedestals to be set in slots cut in the top of the main stand in such a way that they are securely held in place when dropped in the 1-in. holes Dowels are turned on each end of all five pedestals.

The bases are turned on a large faceplate and bored in the lathe to receive the dowels on the spindles. This boring can be simplified by employing a taper shank drill held in the tailstock, provided the lathe is of the taper-center variety. If not, the boring is done with the toe of a small skew chisel.

The trays are first glued to waste stock with paper between them and are turned on a large faceplate. Turn the side with the recess for the glass tray first; then split the tray from its waste stock and use the latter to form a chuck to fit the recess Chuck the tray and turn the reverse side Bore for dowels as with the bases

In assembling, the parts should be glued one at a time, using the lathe centers as a clamp in order to assure strong joints.

The sub-base and subtop are both turned on a faceplate and bored for dowels. Holes for No. 10 wood screws are bored and countersunk in the subtop. These two parts are then glued to the pedestal, the lathe again being used as a clamp.

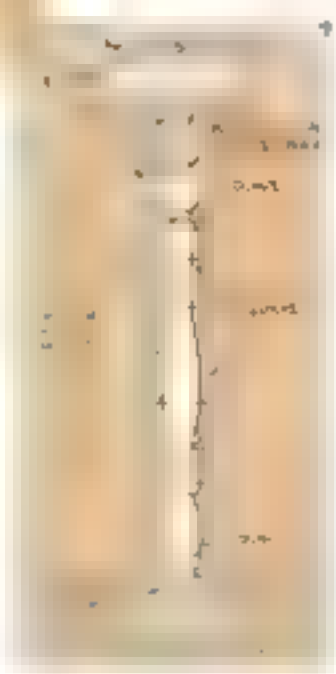
The four feet on the main pedestal can be turned either on a screw plate or between centers, depending on the size stock available and the choice of the worker. The handle

Assembly drawing of the main stand and details of the top rack and base

consists of two spindle turnings, an upright, and a crosspiece held together with a half-lap joint, which is made after they are turned.

The top is made of four pieces mitered together as shown on the drawings and glued with splined (tongued) joints. To insure strength, all splines should be cut from the cross grain of the wood. The top is held in place by 1¼-in. No. 10 wood screws driven from under the subtop, and the joint is reenforced with glue The handle is doweled and glued securely into the top.

The completed four-in-one nest. The decorative cross at the top of the main stand forms a handle for carrying.



Drawing of one of the ash tray stands. Four of these are required.

The base requires a piece of stock 11 by 14 in. Walnut of this width is hard to obtain; and because of the possible checking of the wood it is better to make it of two pieces held together with either a splined or a doweled joint.

Both the top and base are best cut to shape on a band saw, and if none is available it will pay to have this work, as well as the fluting of the edges, done at a lumber mill. In the event these operations are done by hand, care must be taken to keep the curves regular. The fluting can be done with a small gouge, but this requires skill and patience.

The finish will depend entirely upon the material selected. On walnut the writer used one coat of walnut spirit stain, another of walnut filler, and six coats of thin orange shellac Each coat of shellac was rubbed lightly with fine steel wool except the last, which was rubbed with rottenstone and oil. The final polish was applied with a good oil furniture polish The removable ash trays are of the inexpensive glass variety that can be obtained in a wide choice of attractive colors.

Now—A Model of the Army *Hawk*

By DONALD W. CLARK

"Let's have an Army or Navy plane," is the request we have received from many a reader who has constructed the simplified airplane models designed by Mr. Clark. Well, to start with, here is the Curtiss "Hawk," the speedy little pursuit plane used by the Army; and others will follow, all as easy to build as the preceding nine models in this unusual series.

Whittled models require few tools and are constructed from easily obtainable materials.

A side view of a chemically cooled Curtiss Hawk. Notice the N-shaped struts on wings

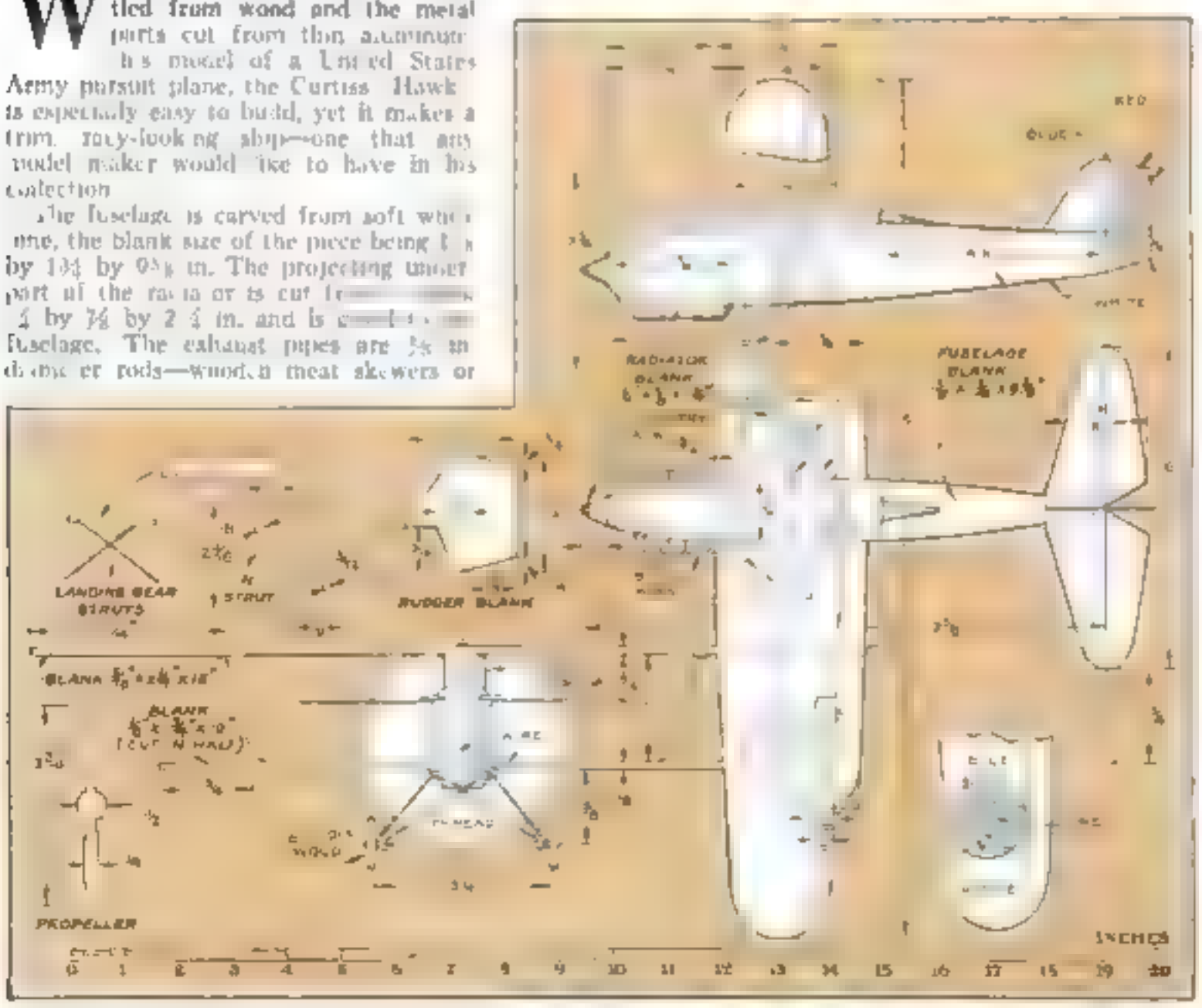
WITH its fuselage and wings whittled from wood and the metal parts cut from thin aluminum, this model of a United States Army pursuit plane, the Curtiss Hawk, is especially easy to build, yet it makes a trim, racy-looking ship—one that any model maker would like to have in his collection.

The fuselage is carved from soft wood, the blank size of the piece being 1 in. by 1¾ by 9⅝ in. The projecting motor part of the radiator is cut from [illegible] ¼ by ⅞ by 2 ¼ in. and is [illegible] fuselage. The exhaust pipes are ⅛ in. diameter rods—wooden meat skewers or lollypop sticks will do—glued in holes drilled in the fuselage as shown. Note that ½ in. of the fuselage at the point is cut off to serve as the spinner for the propeller.

The upper wing is shaped from a piece of white pine 3/16 by 2¼ by 16 in., and the lower wing from a piece ⅛ by 1¾ by 10 in. After it has been prepared in one piece, the lower wing is cut in two and each half is fastened to the fuselage with wire dowels or plugs and glue. The leading edge of the upper wing at the center is 2 in. from the front of the fuselage (with spinner removed), the leading edge of the lower wing where it joins the fuselage is 3 in. from the front.

The tail units, landing gear struts, N-struts, and propeller are cut and filed to shape from 1/32 in. thick aluminum.

Much depends upon how neatly the model is painted. Color the fuselage struts and wheels khaki, and the wings and tail chrome yellow, and polish the propeller. Add the insignia on the top of the upper wing and the bottom of the lower wing and the markings on the tail as indicated.



Drawings of the whittled Army "Hawk" model and details showing the rudder blank, propeller, N-struts, landing gear struts, and insignia. Thin sheet metal, aluminum preferred, is used for the tail units, struts, and propeller

Deck Fittings for Our Destroyer

Making the superstructure for either a working or a display model of the U. S. S. Preston

By CAPT. E. ARMITAGE McCANN

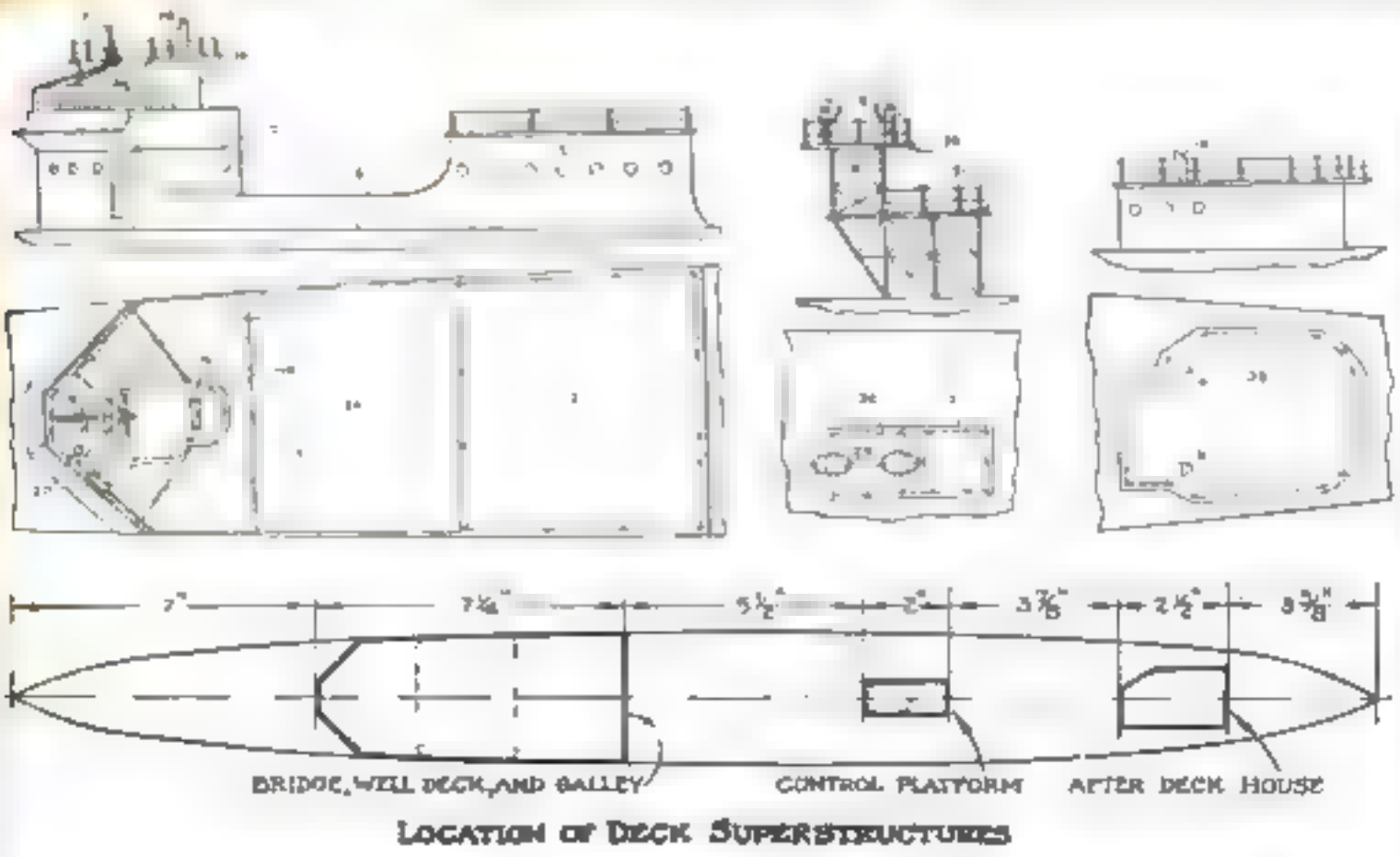
WITH the trim little hull of our destroyer model finished—and fitted with a suitable engine if it is to be used as a working model—we are ready to make and arrange the deck fittings that will transform the hull into a miniature fighting ship patterned after the most modern type of these speedy, ferocious looking little battle craft.

For those who did not read the first of this series of four articles describing the construction of a model of the *U. S. S. Preston*, D. D. 327 (P.S.M., Dec. '30, p. 87), full size plans detailing the construction of this model can be obtained by sending seventy-five cents to the Blueprint Service Department for POPULAR SCIENCE MONTHLY Blueprints Nos. 125, 126, and 127. These blueprints were prepared from plans furnished by the Construction Department of the United States Navy.

The model is built to a scale of ¼ in. equals 1 ft., but a larger scale is recommended if the ship is to be used as a sailing model. This will allow the hull to carry a greater amount of weight and will make it steadier in the water.

The first thing to do in furnishing the deck is to erect the superstructures. These may be made of thin sheet metal or wood, but for ease of construction and lightness they may be cut from bristol board (good quality cardboard). If this is painted within and without, it will be sufficiently strong for decorative purposes. If the ship is to be used as a working model, however, the sheet metal construction should be used, sheet aluminum, because of its lightness, being given the preference.

Starting forward there is the main bridge house. This is made by bending a piece of bristol board to the shape shown in Fig. 4 and providing it with flaps at the top and bottom to allow it to be glued to the decks above and below. The main bridge deck, shown in Figs. 1 and 4 as *14*, is next cut to shape from ⅛-in. pine and glued in position on top of the main bridge house. The sides and front of the bridge house *15*, well deck *26*, and galley *27* are one continuous strip as shown in Fig. 4. It starts at the after end of the galley, house goes right around the fore end of the bridge house and back to the after end of the galley on the other side. Cut the portholes and doors in the front end and



LOCATION OF DECK SUPERSTRUCTURES

Fig. 1 The superstructure and its location on the deck. These deck fittings, shown approximately one third actual size, are full size on the blueprints (see page 107).

along the sides of the galley as shown. Only the portholes in the bridge house are glazed. This can be done by placing thin celluloid behind the bristol board. Note that the after end of the galley is higher than the fore.

Before placing this continuous strip in position, erect the galley and

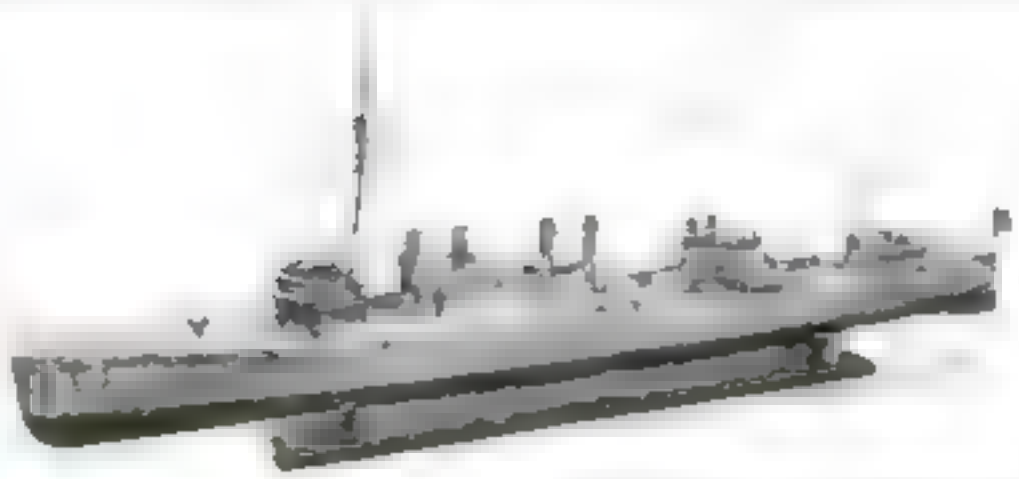
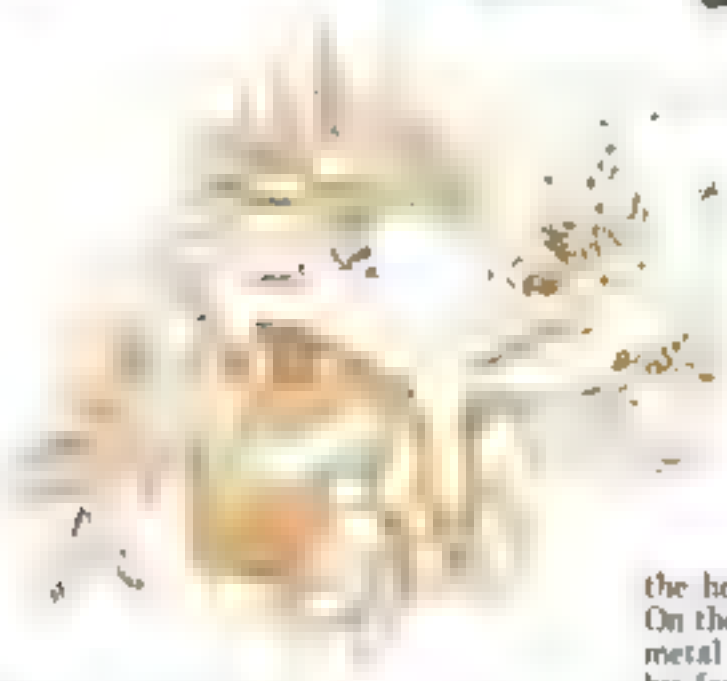


Fig. 2. Set up on a suitable stand, the model is an excellent decoration



place the galley roof or deck. The galley house is constructed as shown in Fig. 4. In the center is a wooden block hollowed out in the center for lightness, and in each corner is fitted a small block of wood. These stiffen the sides and serve to take the nails, stanchions, and ringbolts.

Glue the cardboard fore-and-aft bulkheads to the galley. These have doors on either side and the usual flaps for gluing. Next glue the galley deck in place and arrange 14 two-ball stanchions on the deck as shown in Fig. 1.

In making the bridge deck protection from bristol board as shown in Fig. 4, pierce the front portion for narrow windows, and behind this glue some thin, transparent celluloid for glass. Paint the inside of it and glue it around the bridge deck. The slot for the ladder gangway on the after end should not be cut out until the glue is dry. This deck protection fits inside of the long continuous strip, and the flaps along the sides of the bridge end of the long strip are glued to the sides of the bridge deck, giving a double thickness of cardboard at this point.

Across the three front edges of the bridge is a parabolic windshield. In reality, this is a V shaped metal projection with a half-round metal piece hinged to it so that when the latter is turned up it shoots the wind over the heads of the observers on the bridge. On the model this can be made from sheet metal or carved from wood, the latter being by far the simpler. The general shape is shown in the perspective of Fig. 4.

Before building up the flying bridge, the fittings on the navigation bridge should be placed. These are shown in a group as the binnacle, steering gear *19* and engine room telegraph *20* (Fig. 3). If desired, a small wooden grating may be placed abaft the wheel.

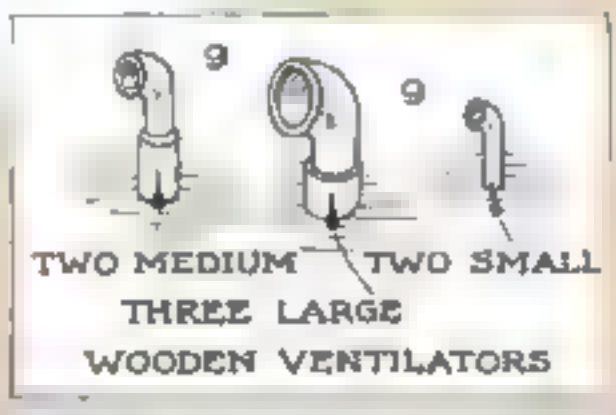
On the main bridge deck comes the emergency cabin. This is made by bending cardboard to the shape shown in Fig. 4. Portholes should be supplied on three sides and a door placed abaft. From the top of this house to the bridge protection are five awning spars; these are shown in Fig. 1. Small diameter wire run through the emergency cabin and down to the deck protection will serve.

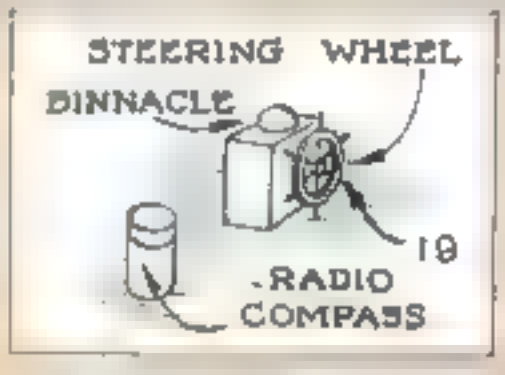
Glued to the top of the emergency cabin is the flying bridge (see Figs. 1 and 4). On this is placed the range finder *17* and directorscope *18*. In reality the directorscope is a complicated piece of apparatus, but since it is covered with a canvas hood unless the ship is in action, the general shape shown in Fig. 3 will be good enough for our model.

Spaced around the flying bridge are 13 two-ball stanchions (see *11*, Fig. 3). They can be turned from brass rod or bought ready-made from ship model supply houses. The holes for them should be placed as near to the edge of the bridge deck as possible. To represent the iron bar rails, No. 32 wire is the best but thread can be used. It is easier to thread the stanchions before placing them.

The after deck house is shown in Figs. 1 and 4. Glue this in the position shown and glue the after house roof or deck in place. On top of this deck are placed two small ventilators *9* and *10* two-ball stanchions. Be sure to leave spaces where the three ladders come. The auxiliary steering gear and radio compass, shown as a group in Fig. 3, are also placed at the forward end of the after house deck. The steering gear and binnacle are placed in the center directly back of the forward handrail. The radio compass goes in the forward port corner.

The position of the control platform is shown in Fig. 1. The searchlight platform rests on the control platform. These





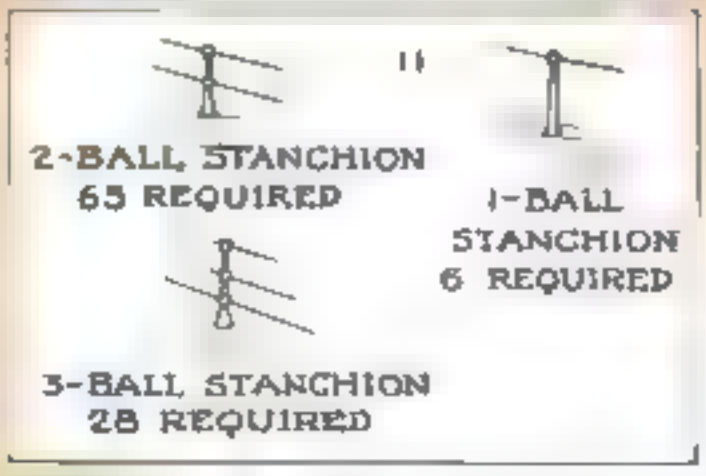


Fig. 1. Sketches of the range finder, searchlight, ventilators, stanchions, emergency steering-gear group, navigation bridge steering-gear group, and directorscope.

should be made together. Drill the control platform for eight wire supports as shown in Fig. 4, and bore the searchlight platform for six. Holes for the handrail stanchions should also be made at this time.

In assembling the platforms the three after supports on the searchlight platform go through the control platform to the deck; the forward ones go through both, are bent back and are then soldered to the feet of the former. Between them all is a lattice stiffening. On the original ship this lattice was angle iron, but on the model thread was used. Both platforms are supplied with two-bait stanchions and handrails.

The search lights are shown as 29 in Fig. 3. A round wood disk forms the base into which is inserted two sheet metal arms which hold another wooden disk, a pin being used as a pivot. The lenses in the searchlights can be represented with a piece of mirror or tin foil. These are placed at each end of the searchlight platform as shown in Fig. 1. However, before the searchlight and control platforms are placed permanently on the deck, the engine room skylights, to be described in the article next month, should be made and put into position on the main deck.

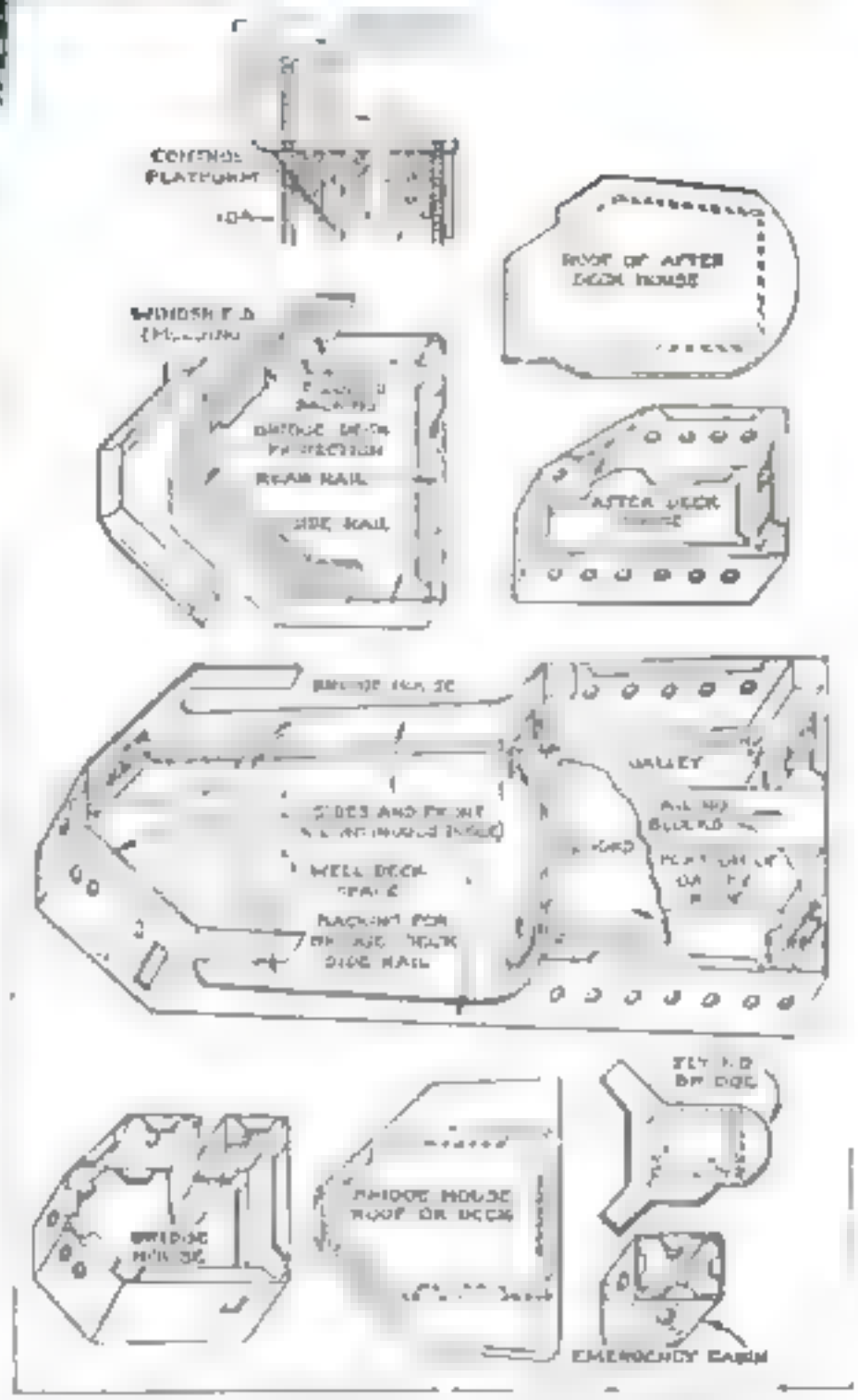


Fig. 4. Perspective sketches of the control and searchlight platforms, bridge house, flying bridge, emergency cabin, and galley

TIPS TO HELP YOU USE BRUSHING LACQUERS

MANY amateur craftsmen who make and repair articles for home use know the advantages of modern brushing lacquers. The writer has found lacquer an excellent finish for serving trays, breakfast sets, bedroom suites, and even wall furnishings. Brass door plates or copper candlesticks, if polished, washed, dried, and coated with clear lacquer are permanently preserved from tarnishing.

Anyone who observes carefully the directions on the label of the lacquer can and uses a brush of good quality should be able to produce the same semigloss, porcelainlike finish that has become a joy to so many home artisans.

Before a new or repaired piece is lacquered, it is necessary to fill any bruises, imperfect joints, countersunk screws and nails and other depressions in the surface, yet lacquer will simply blister and pull off if applied over an oil putty, and some of the commercially prepared crack fillers seem to contain some ingredient that causes lacquer to blush if used over it. A putty which the writer has found satisfactory for use under lacquer can be prepared as follows:

Mix whiting with enough lacquer of the color being used to form a medium-stiff putty. Do the mixing with a putty knife on a piece of glass or sheet metal. Work into this paste one third as much muriatic acid as you used of lacquer kneading with the putty knife until all "boiling" action has ceased. A small amount will fill a surprising amount of surface defects. If it becomes too dry while using, add a little more lacquer and a bit more of the acid. Should the knife drag in smoothing off the putty, moisten the blade with the acid. When the putty is dry, rub it with a fine grade of sandpaper and go ahead with the finishing operations.—C. E. LEEDY

How to Get the Most Out of

Your Bench Planer

Novel method of mounting—Hints on the proper care of the blades

By DONALD A. PRICE

BESIDES producing a surface of smoothness and accuracy that can be equaled only by extraordinarily careful handwork, the small jointer or planing machine is a genuine timesaver. To do accurate work quickly and smoothly, however, the jointer must be kept in first-class running order, the blades must be sharp and correctly adjusted, and the machine must be mounted with a thought for operating ease and efficiency. This part of the work is entirely up to the home worker, since the best machine on the market will not give satisfactory results if the blades in the cutter head are dull and not properly adjusted

In most cases the jointer will be received from the manufacturer ready to run after those parts removed for convenience in packing have been reassembled. In any case, the following points should be checked over after giving the machine a thorough cleaning.

1. Try out the various adjustments to see that they work smoothly but without perceptible play. Chips or metal particles left from machining should be looked for and cleaned out. Oil the screws and slides and run them over their entire travel.

2 Inspect the cutter-head bearings and clean and oil or grease if necessary Try the head for side play If any is perceptible you will find it impossible to do good work on the machine. There should be only about .002 in. clearance between the shaft and bearing to allow for an oil film. However, do not confuse side play with end play, which usually can be taken up by moving the drive pulley up closer to the bearing.

3. Check up to see that the special adjusting wrenches, if any are necessary, are included It will pay to arrange all the wrenches used in operating in some convenient and handy way. A suggestion for this is shown in Fig 1

The manner in which the machine is mounted has much to do with the convenience with which operations can be carried out Many of the commercial workshops mount the jig saw, circular saw, and jointer interchangeably on the same base, driving them by means of the motor that forms the lathe headstock. This arrangement has the advantage of compactness so desirable where the working space is limited. However some workers feel that the separate method of mounting is to be desired. The same results can be obtained by the possessor of a unit shop by mounting his jointer unit and a suitable motor on a wooden base of his own making. Such an arrangement is shown in Figs. 1 and 6. A flat rubber fabric auto fan belt is used in this case to connect the jointer and motor The proper belt usually can be obtained from the manufacturer if a special V-section belt is required for the machine's pulley

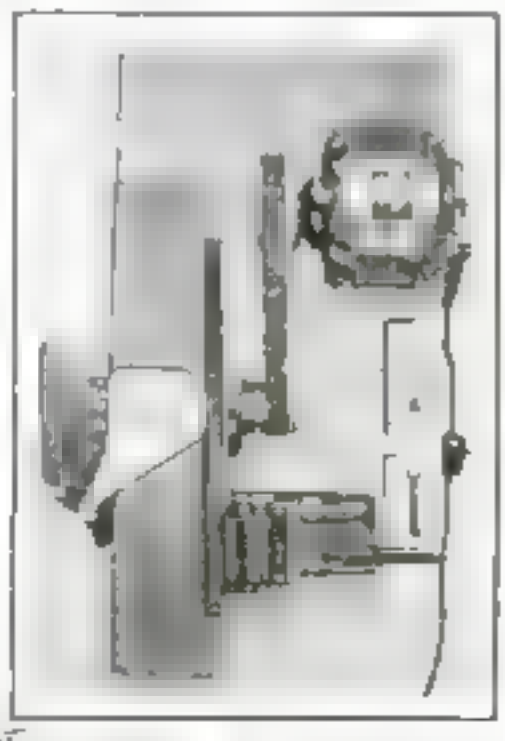


Fig. 1. Top view of the planer mounted.

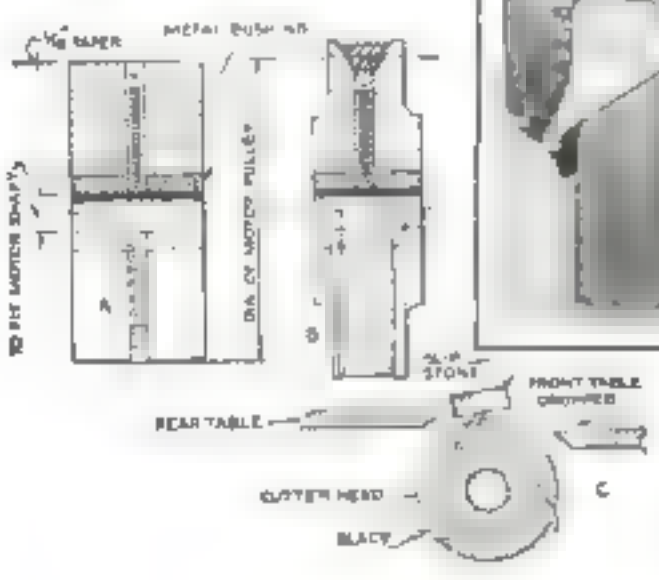


Fig. 2. (*A* and *B*) The two types of pulleys. (*C*) A makeshift way to sharpen the blades.

The motor pulley can be purchased or turned up on the lathe to either shape given in Fig. 2 (*A* and *B*) A steel or brass bushing is made to fit the motor shaft and glued in a suitable block of wood, which is then mounted on a mandrel in the lathe and turned to the proper size and contour. The set screws, two being used for balance, are placed on opposite sides These are made from ¼-in. flathead stove bolts by turning the heads down to a ¼-in. diameter The motor pulley size may be calculated by the following formula.

Dia. of st. p. = dia. of jointer pulley × r.p.m. of jointer / r.p.m. of motor

The average speed for a jointer having three cutting edges may be taken as 3,450 R.P.M., and the speed of the usual single-phase motor is 1 725 R.P.M Substituting these values in the equation given above we have

Dia. of st. p. = dia. of jointer pulley × 1,725 / 3,450 = dia. of jointer pulley × ½

If a motor of different speed is used, substitution must be made in the formula accordingly. The actual speed of the jointer, if the pulley is made according to the above figures, will be somewhat less than 3,450 R.P.M. because of belt slippage and the slowing up of the motor under load. A 1/6-H.P. motor such as is generally used on washing machines will perform efficiently in driving a 4-in. jointer. If a 1/3-H.P. motor is available a somewhat larger motor pulley can be used as the motor will have more power to pull the jointer at a higher speed. The stock can then be fed through faster

After a certain amount of use—sooner if oak and other hardwoods are cut—it will be found that small ridges are left on the work by the blades and it will be

hard to hold the work down on the jointer blades, especially if a wide cut is being taken. Examine the blades and you will notice that the original sharp edge is rounded over and that small nicks have put in an appearance

Makeshift sharpening may be accomplished by using a small slipstone as shown in Fig. 2 at C, but the best way to regain the accurate, keen edge is to remove the blades and regrind them in a simple wooden jig as sketched in Fig. 4 at *A*. In making this, the angle *a* should be obtained from the blades before regrinding. It will vary with the make of the jointer, but is usually about 35° or slightly over

The holder block can be made of maple, birch, ash, or any other tough hardwood and can be shaped on the jointer itself before the blades are removed. A piece of the section required about 1 ft. long should be made and a 6-in. length cut off. A long piece is shaped at first to eliminate the danger that accompanies the working of small pieces. Roundheaded wood screws ¾ in. long are used to clamp the blade in place

For grinding the blades, use a regular sanding disk to which emery cloth of a rather fine grain (about equal in grade to No. 1 sandpaper) has been glued. The grinding table should be set up square with the surface of the disk. This operation is clearly illustrated in Fig. 3. When grinding, the jig is held down firmly on the table with both hands, fed up slowly to the disk, and then slid back and forth across the emery face. Do not remove any more metal than is necessary to take out the small nicks

If much rabbeting has been done on the jointer, the one corner of the blades will probably be rounded over If this is the case the blades should be ground until the corner is squared up. The writer has found it advantageous to grind a cutting edge on one of the blades on the end which does the rabbeting (see *B*, Fig. 4). This blade is then set out slightly farther, and in use cuts a clearance for the blunt ends of the other two blades and the cutter head.

If desired, the grinding disk can be mounted on a saw table. The main requisite, however, is to have a table at right angles to the disk on which to support the jig. We should advise not attempting to sharpen the blades on the circumference of an ordinary grinding wheel as the chances of obtaining an accurate edge are extremely slim unless a very elaborate rigging is used.

After being ground, the cutter should

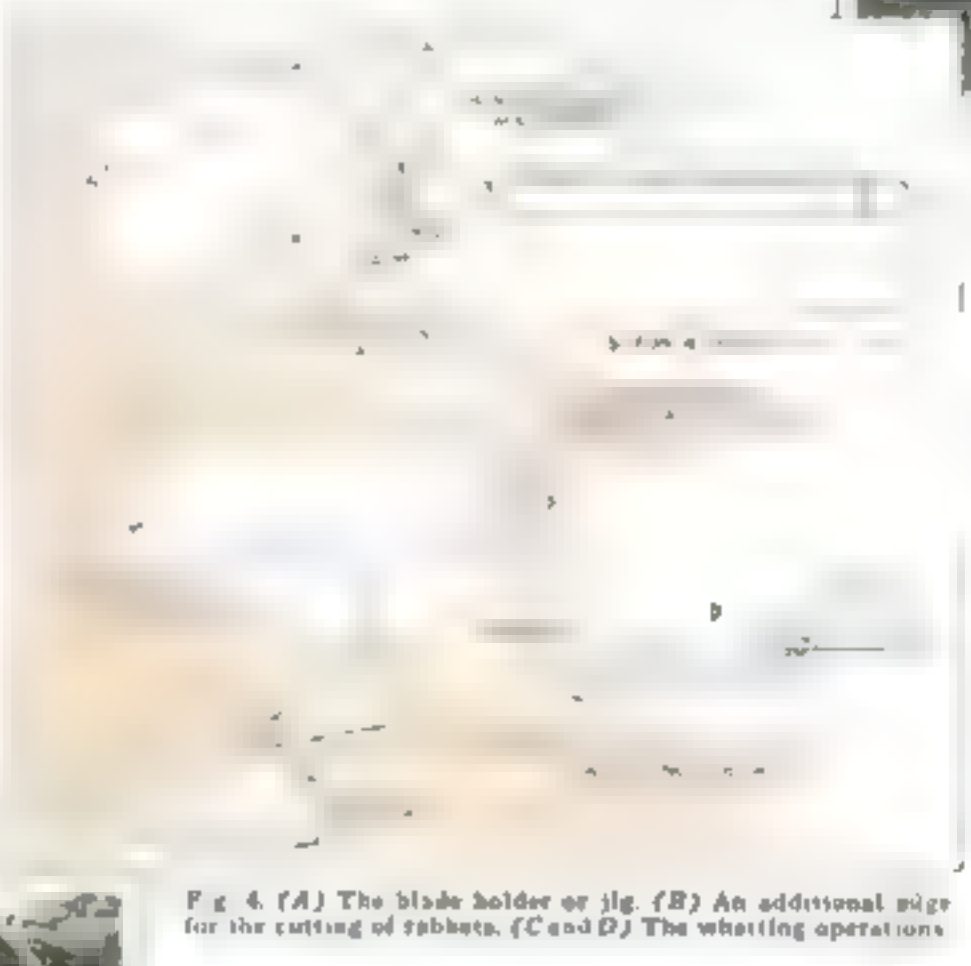


Fig. 4. (*A*) The blade holder or jig. (*B*) An additional edge for the cutting of rabbets. (*C* and *D*) The whetting operations

Fig. 3. How the blade jig is used to hold the blade during the sharpening operation

be whetted on an oilstone having a true and level top as shown in Figs. 4C and 5 The blade can be handled easier if it is left right in the jig. Hold the blade and jig at an angle of about 10° as indicated in Fig. 4C. Occasionally turn the blade over and take a stroke or two on the flat side to remove the wire edge. The whetting should be continued until a bright edge shows along the whole length of the beveled side of the blade and until no burr can be felt on the flat side. Be sure to hold the blade steady

We are now ready to place the knives back in the head, but before doing so remove the fence, if it can be done, to obtain as much working room as possible Run the rear table up as far as it will go and then slacken it back for about a half turn of the adjusting screw. Then bring the front table up in line with the back table, testing by means of a straightedge

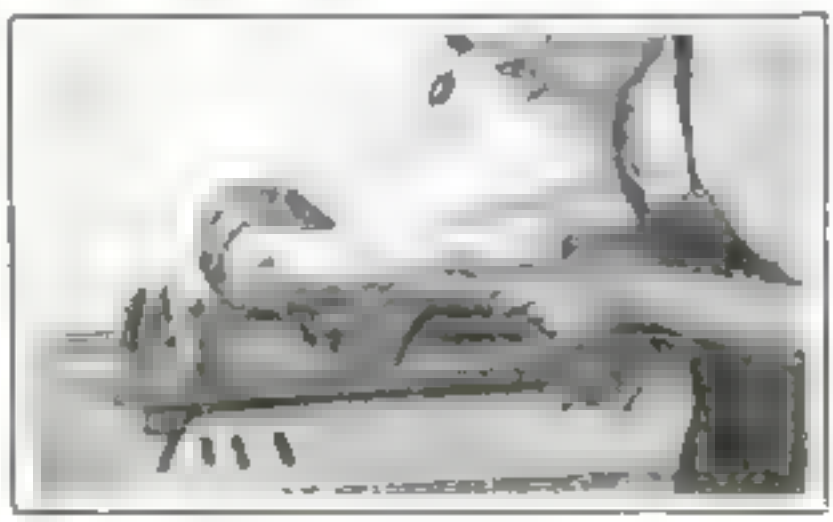


Fig. 5. Testing the height of the blades by noting the distance that a straightedge is moved back by each blade.

Fig. 3. How the blade is held while rubbing it on the stone.

Place the knife in the head with the straightedge over it in the middle of the table. Adjust the knife until it presses lightly against the bottom of the straightedge and then clamp the blade in place. Rotate the head toward you, noting by means of pencil marks (shown in Fig. 6) the distance the straightedge is moved. Try the straightedge at each end of the knife and adjust the blade until the straightedge is always moved the same distance, no matter where it is placed on the blade. Without changing the adjustment of the table, adjust the other knives in the same manner until the same movement of the straightedge is obtained

In order to do good rabbeting it is necessary to have the left end of the knives project slightly from the end of the head. Always give a final tightening to all screws or bolts, followed by a final test of accuracy, before turning on the power and making a cut

Now replace the fence, setting it square with the table, and the jointer is ready for another period of accurate use

In an article to follow, Mr Price will outline the correct methods for making the principal cuts on a bench jointer.

PAINTING HINTS FOR THE HOME WORKER

IN STIPPLING flat wall paint, better results often can be obtained by the addition of a small amount of dry whiting to the ready-mixed paint. Any desired texture can be obtained through the use of either more or less whiting

Half a bar of laundry soap dissolved in each pail of glue wall size that you use will improve its covering qualities and reduce the tendency of the size to crack because of brittleness after it is allowed to dry

Glue size can also be made to penetrate into the plaster more readily by the addition of a small amount of ordinary table vinegar

One quart of size will generally cover from fifty to seventy square feet of wall area

Ideas Valuable to Auto Mechanics

Novel way of charging wholly dead battery—How wedge closes a rim

POPULAR SCIENCE MONTHLY awards each month a prize of $10, in addition to regular space rates, for the best idea sent in for motorists. This month's prize goes to Joe Hodge, Richfield, N. C. (Figure 1). Contributions are requested from auto mechanics.

Fig. 1 shows how to rotate generator to charge battery.

WHEN the battery has accidentally become discharged, the hand crank will fail to start the motor. If this happens to you when you can't borrow a battery or get a tow there still is one last resort. Take off the fan belt and rotate the generator many times by the aid of a cord wound around the pulley. This will put enough juice in the battery to start the motor with the hand crank.

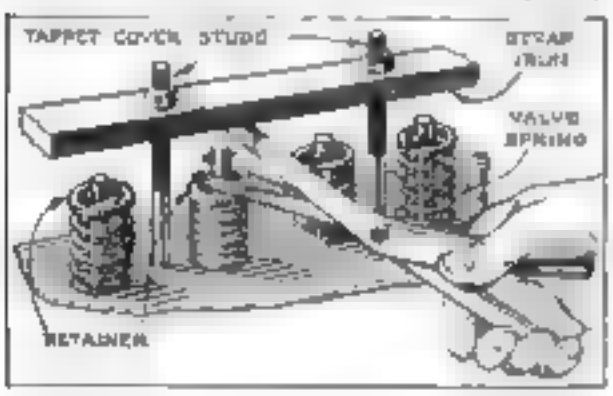


Fig. 2. A steel bar fitted to the studs affords purchase so overhead valves can be removed.

VALVE AID

THE chief difficulty in removing valves of the overhead type by the aid of a conventional lifter is the absence of anything against which to rest the tool. A way out of this trouble is shown in Fig. 2. After the rocker arm shaft has been removed, fit a steel or hardwood bar on the studs as illustrated to provide the necessary purchase.

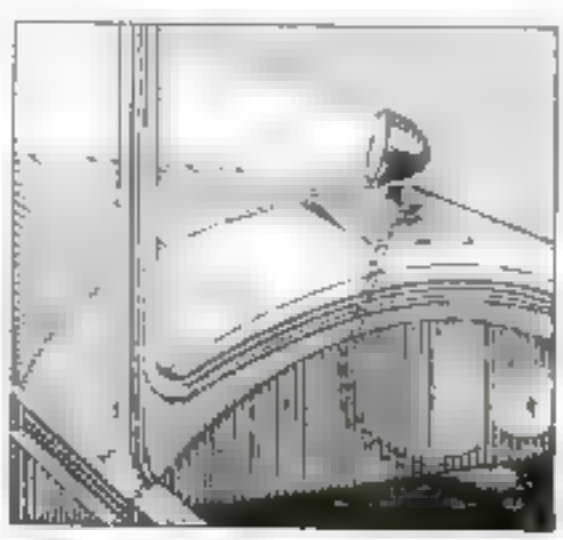


Fig. 3. Spotlight mounted on cowl ventilator can be moved with a hand lever.

SPOTLIGHT

ON CARS fitted with a cowl ventilator, it is often possible to mount a spotlight as indicated by the drawing in Fig. 3. Opening the ventilator will point the spotlight up as much as desired and a hand lever can be used to turn it to right or left. Of course, a ball-and-socket joint could be used on a plain cowl.

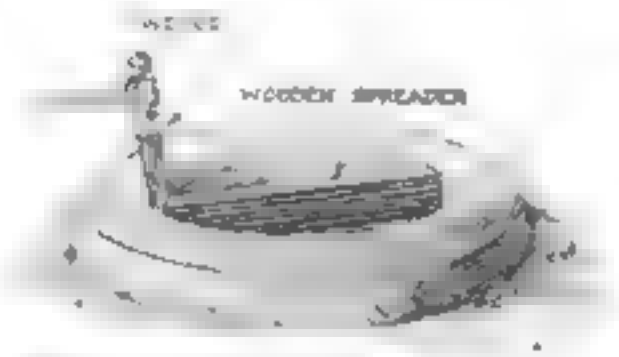


Fig. 4. A piece of board and a wedge are handy to force a rim into locked position.

WEDGE CLOSES RIM

FIGURE 4 shows how to use a piece of board, a wood wedge, and a hammer to force a rim into the locked position. Both the board and the wedge should be made of hardwood. The board should be not less than an inch and a quarter thick and wide enough so that its lower edge will be supported by the ground.

This is similar to the common way, using a jack supported by a board to give the necessary force.

TIRE STRETCHER

AFTER you have labored in vain trying to hold open a tire casing while you search for the break in the fabric that has chafed through the tube, make yourself a stretcher as shown in Fig. 5. Be sure to cut the notches in the board so deep that it will not slip. While one stretcher will serve in most cases, two will often prove more convenient.

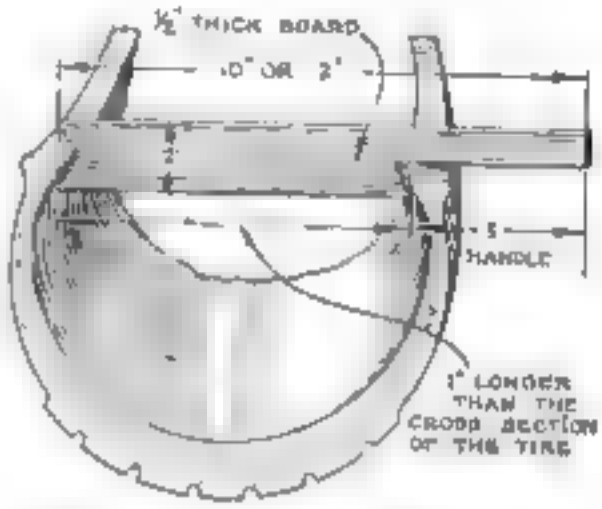


Fig. 5. Spreading a tire casing in search of a break is a small job if you use this device.

RUBBER MAP POCKET

MAPS, route cards, and so on may be carried conveniently in a special pocket under either of the front seats. Take a section of inner tube and split it lengthwise as indicated in Fig. 6. When the pocket is in place under the seat it will hold papers so that they can not jar out. After the pocket is in place, put in the center tack. Then stretch the back edge both ways from the center and tack it securely, first on one side and then on the other to maintain even tension.

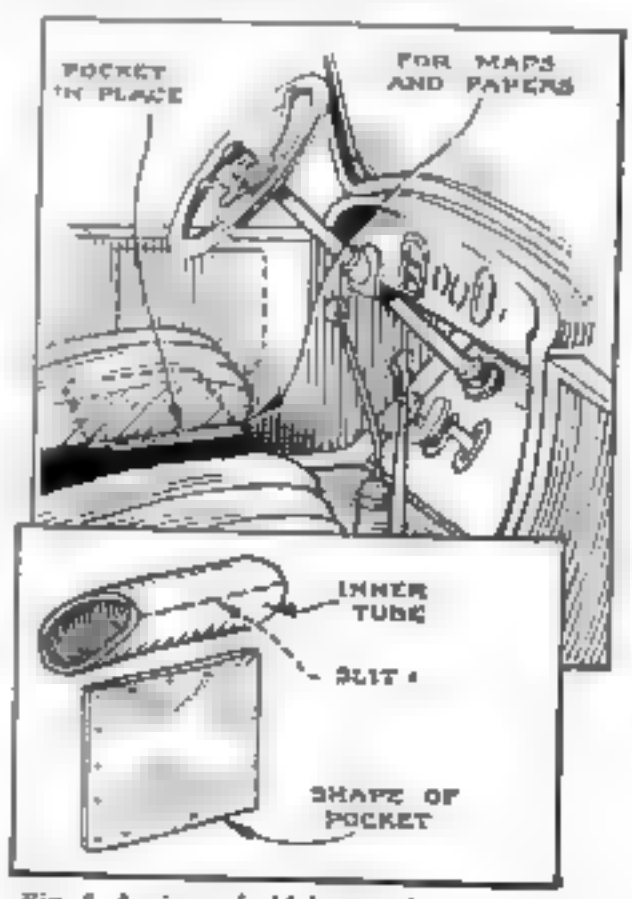


Fig. 6. A piece of old inner tube, cut to size and fitted in place, serves as pocket for maps.

Lighting Your House Number

By HERBERT WOOLSEY

Two small lamps hooked into the doorbell circuit provide the illumination

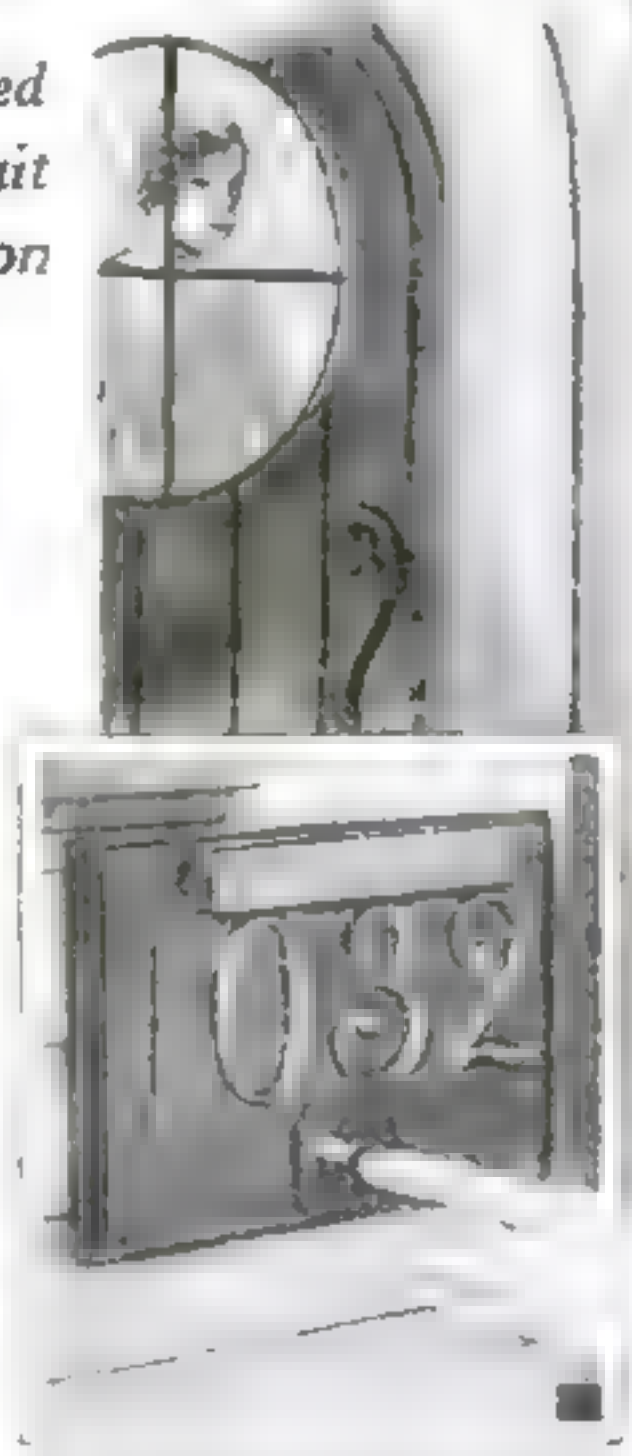
IF SOMEONE told you that, for less than a dollar a year, you can illuminate your house number and the front-door keyhole, would you believe it?

Nevertheless, it is true, according to engineers of one of the largest manufacturers of electrical supplies. And you can install the lighting equipment—what little there is of it—yourself

You must, first of all, have a doorbell that is operated by a transformer. Such transformers, obtainable for seventy-five cents or so, are permanently connected to the house lighting circuit and draw so little current that the cost is negligible. If your doorbell operates from batteries, it is a simple matter to substitute a transformer, providing a 110-volt alternating current supply is available

Next, you will need two 6-volt No. 40 lamps such as those used to illuminate radio dials. Mount them in suitable sockets and in such a position that they will throw light on the house numerals, and connect them *in series* between the two terminals of the doorbell button. It is important that the lamps be in series, not in parallel, because most transformers give out 10 or 12 volts—too much for two 6-volt lamps connected in parallel

The lamps perhaps will not burn at maximum brilliancy when connected in series, but they will give sufficient light for the purpose. They draw so little current—in the neighborhood of 0.15 ampere—that they will not cause the doorbell to ring, although they are short-circuited across the button. When the bell is rung the lights will go out for the time the contact is maintained. The lamps, of course burn in the daytime, but they are hardly noticeable, and they cost so little that it does not pay to turn them off



The miniature lamps are placed in a reflector above the number. The bell button goes below. Two lamp reflectors can be used if desired.

A [illegible] number is a real aid [illegible]

The two lamps have a life of approximately 4,000 hours. That means you will have to renew them only twice a year The cost of each lamp is about ten cents

Of course, you may place the lamps anywhere in order to throw light upon the house number, but a neat arrangement, which was suggested by G. F. Prideaux the electrical engineer who designed the idea is illustrated by accompanying photographs. The [illegible] side of the reflector may be closed with glass if desired, this will prevent [illegible] from taking the lamps

Construct a base of some hardwood, such as birch, maple, or oak, the dimensions depending on the size of numerals and other parts to be mounted The house number should be made of some light-colored material that will reflect light readily; lacquered brass or aluminum is suitable. Sheet copper is an excellent material from which to fashion the shield

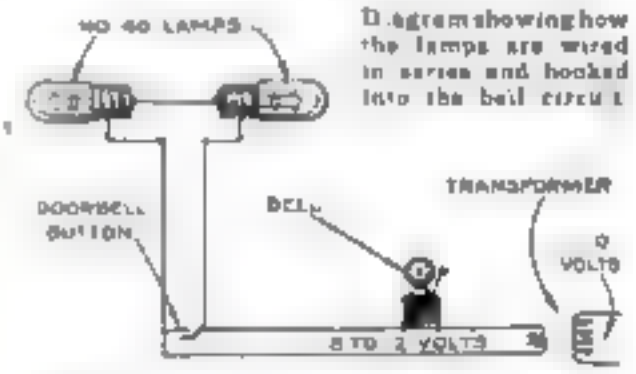
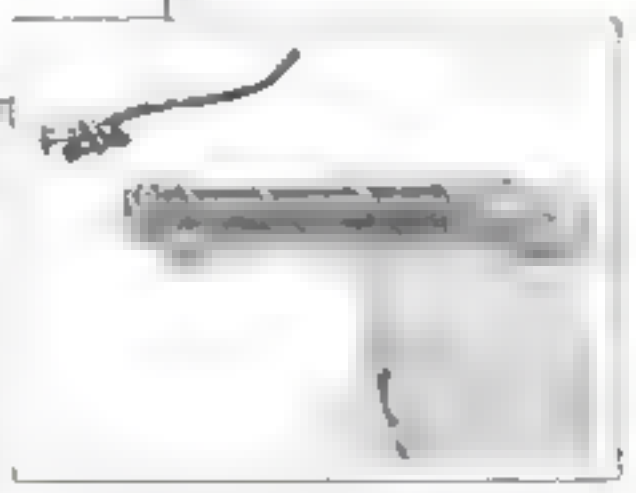


Diagram showing how the lamps are wired in series and hooked into the bell circuit

The back of the baseboard with the wires set in grooves cut with a chisel or a circular saw.



How the bulbs are mounted on rubber tubing. The center contacts inside are small screws.

You may obtain miniature sockets for the lamps or make substitutes by wrapping No. 14 bare copper wire around the grooves in the base, fastening the resulting springlike arrangement to a rubber tube or other insulating support, and providing center contacts—small brass screws will do—that are insulated from the remainder of the mounting.

Connect the button and lamps according to the accompanying wiring diagram, and if possible mount the board so that light also will be thrown on the keyhole.

Building a *Graceful* Table

By RICHARD L. GRAVES

Hand-rubbing the top of the library table to a mirror-like luster. So beautiful a piece of furniture deserves to have the finest finish.

BY FOLLOWING the design shown in the accompanying drawings and by taking special pains with the finishing process, any reasonably competent home worker can build a library table of unusual beauty.

Mahogany was the wood chosen by the writer, but walnut, gumwood, or any other first-class cabinet hardwood may be used.

The first step is to turn the legs. It will be seen that 4 in. at the top of the leg is left square, and ⅞ in. is left at the bottom to be shaped eight-sided. The legs should be well sanded while still in the lathe; this will save work later on.

Next the feet should be made. Each should be carefully sawed with the grain running the long way, and shaped with a spokeshave. Make the joints and glue the feet on with two dowels as shown in section *C-C*. When the feet are finished and well sanded, drill a ½-in. hole in the top and insert the leg.

The side and end rails should now be made. These are mitered where they join the corners, and a tenon is sawed out of the large end of each of the four end rails as shown. The end rails should be glued to the side rails, fastened with corrugated fasteners, and reënforced with corner blocks.

Mortise the top of the leg to receive the end rails. Also make the stretchers and cut them to the correct length (figure this carefully if the size of the table has been changed), allowing extra for the tenons on their ends.

Working drawings of the table. While only quarter of the top and [illegible] side elevations are shown, the [illegible] sections give the full length

Sandpaper all the parts thoroughly and, when you are sure everything fits properly, glue them together. Freshly made hot glue of the best quality is surest and safest for this type of work, in my experience.

The top undoubtedly will have to be glued from narrow boards. As good a match as possible should be made. If you do not have a power shaper in your shop, it is advisable to take the top to a woodworking shop and have the molded edge cut around it. Fasten the top with four or six screws put through the side rails.

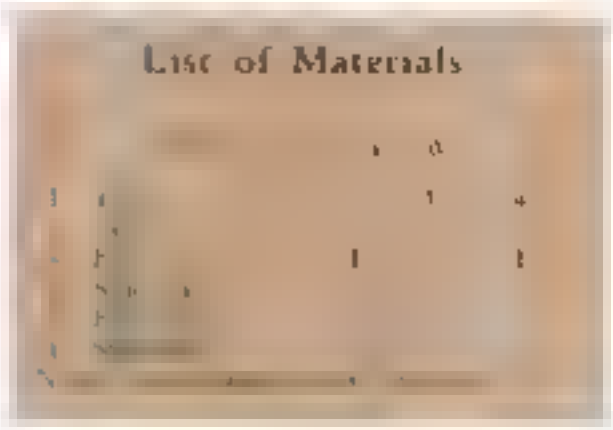
Have the work perfectly sandpapered and dust free before the finishing is started. Then stain it the desired shade. If an open-grained wood, such as mahogany, walnut, or gumwood is used it must be filled with a good paste filler. Add enough powdered stain to bring the filler to the desired color, if it is not purchased already colored. The paste should be thinned to the consistency of thick cream. Apply it with stubby brush. Remember the idea is to *fill* the grain, so work it well into the pores by brushing both with and across the grain. Allow this to dry for from twenty to thirty minutes, then remove the surplus filler with a piece of burlap by rubbing across the grain. It is a good plan to sand the top lightly after the filler is dry with No. 0 sandpaper.

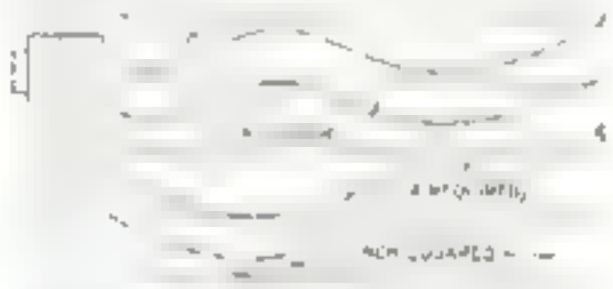
After letting the piece stand for twenty-four hours, you are ready to apply the first coat of varnish. Be sure that the work is free from dust. It is a good plan to sprinkle the floor of the workroom before starting. Use a good grade of varnish and a new or perfectly clean brush, and apply the varnish as evenly as possible.

The first coat should dry for at least four days, as the varnish must be very hard before it is rubbed. Do not overlook this point, it is most important. Use No. 4 0 or 6 0 waterproof sandpaper for rubbing the top, and keep the paper wet with water. A fine grade of steel wool is probably preferable for use on the legs since it is rather difficult to use sandpaper on such irregular surfaces.

When the surfaces are smooth and the specks removed clean carefully and apply the second varnish coat. Allow this to dry for at least two days. After removing the high spots with fine sandpaper, this time dipped in rubbing oil or sewing machine oil instead of water, rub the top with fine pumice stone and oil using a small felt pad. Follow with rottenstone, which will give a beautiful luster to the top. The legs and feet however will have to be smoothed with fine steel wool as it is difficult to rub these with the pumice or rottenstone both because of the danger of cutting through the varnish on the edges and the labor of cleaning the powder from the corners and crevices. Indeed great care must be taken throughout not to rub the varnish too long and vigorously at the edges and corners.

List of Materials



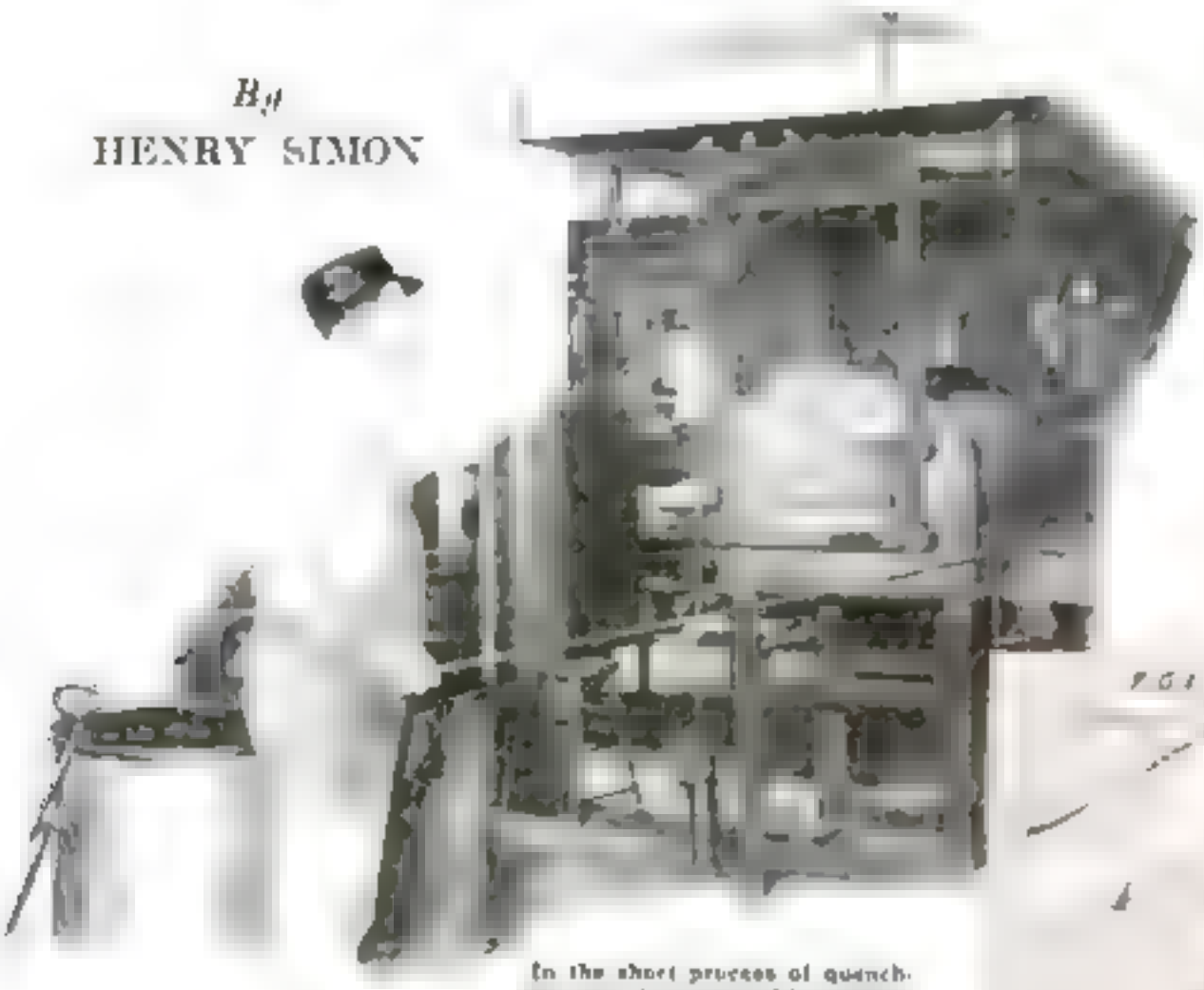


Half the stretcher and one of the four feet drawn on [illegible] squares for easy enlargement

Better Ways of Quenching Steel

The effect of finishes on hardening—Preparing the work—What bath to use for a specific job

By
HENRY SIMON



In the short process of quenching rests the secret of hardening.

BOTH heating and quenching have a marked effect upon the quality of finished steel parts—either may "make it or break it." While it is true that with some work the manner in which it is quenched makes little difference, there is a rising scale of penalties for errors in quenching as steels get finer and the parts more intricate. Indeed, quenching is an art—a simple art, but one that must be studied and practiced if success in hardening is to be assured.

All of the failures shown in Fig. 1 may be due to faulty heating, but each one of the troubles portrayed—warpage, failure to harden, hair cracks, and fracture—may be, and frequently are, caused by improper quenching. By the common-sense application of a few simple quenching rules, almost all of these poor results can be avoided.

In order to insure success in hardening, there are five factors that must be right about quenching. These are the finish on the work, the preparation and design of the work, the kind of bath used, the temperature of the bath, and last but requiring the most thought and skill, the manner of quenching.

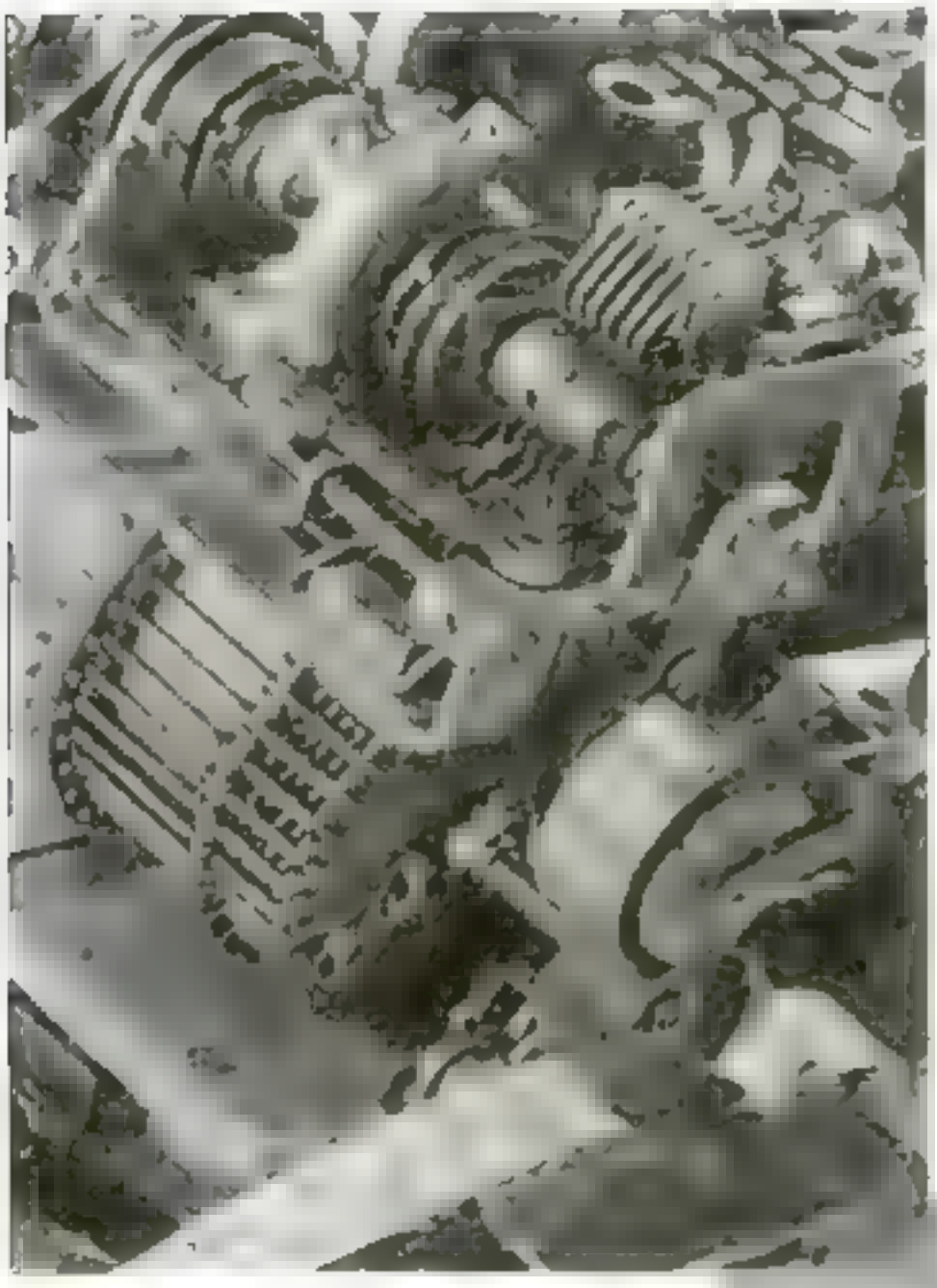
To some it may come as a surprise to learn that the finish on a piece of steel has anything to do with its hardening qualities. Finish does not as a rule make a great deal of difference with very small parts, and not so much with oil-hardening steels, but it is quite important, however, with dies, punches, and parts of any size, especially when made of a water-hardening steel. A die like that shown at *A* in Fig. 2 frequently comes out of the quenching bath hardened on the bottom side and soft on the top, where it should be hard, simply because the top had been finished by grinding and perhaps polishing, while the bottom was left as the planer had finished it. On the other hand, a thin part like that shown at *B* may warp badly, merely because the finish was different on the two sides *a* and *b*.

Neither a very high nor a very rough or "ragged" finish is good for hardening because of what happens in the quenching. The reasons, or some of them, are indicated at *C*, Fig. 2. The high finish at the left presents much less surface to the quenching fluid than the medium finish in the center, and, for some cause not fully understood, seems to repel the water. On the other hand, the tearing cut that was used on the sample at the extreme right produces craggy scratches that trap steam bubbles in water quenching, and these prevent the bath from extracting the heat as rapidly as it should. In delicate parts, like those at *D*, such deep scratches, when near a corner, may set up hardening strains that will cause hair cracks first and a fracture in the end.

It will be seen that no amount of care in heating could give any insurance against such troubles, because they have to do only with the quenching. The same is true in another way about the preparation of the work. Screw holes and other small openings that need not have absolutely

Failures in hardening due to poor quenching and choice of finish (Figs. 1 and 2). Preparing and designing intricate parts (Fig. 3). It is especially important to avoid sharply cut inside corners.

STARRETTS and the NEW STOCK TICKER



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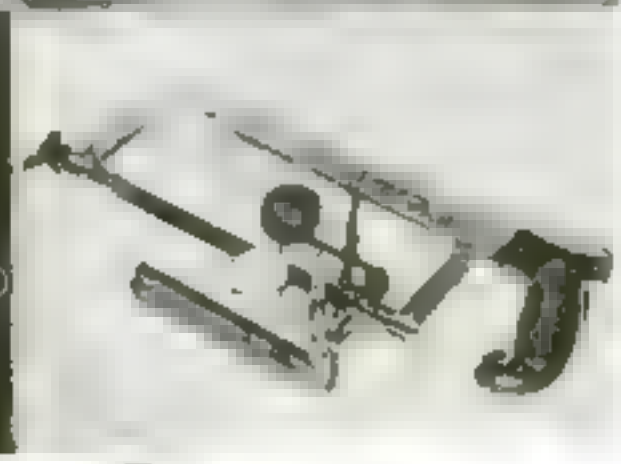

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FIG. 4

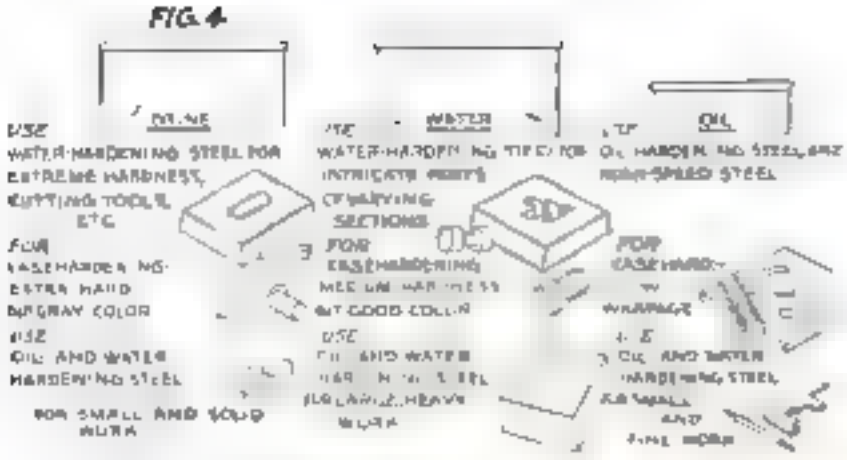


Fig. 4. The chief uses and main characteristics of quenching baths.

hard surfaces should be plugged as a rule, with asbestos.

In the tool steel disk in Fig. 3, there is less risk of hair cracks and uneven shrinkage with the part prepared as at *A* than as at *B*. Similarly, sharply necked portions, deep slots, and the bottoms of bores in parts like those at *C* and *D* are often protected to advantage by wads or shields of asbestos applied in the manner shown. A point that ought to be mentioned in this connection is that wherever possible, sharp *inside* corners should be avoided in a piece that is to be hardened. The design of the parts at *F* is far superior, from the standpoint of hardening, to the sharp-cornered shapes at *E*.

The kind of quenching medium used and its physical condition are matters of the utmost importance if proper hardening results are to be obtained. Water used for quenching should be as soft as possible. No quenching bath should ever be allowed to get foul and dirty. For oil quenching, use some special quenching brand rather than lubricating or cylinder oil. The chief uses and characteristics of the three main quenching baths—water, brine, and oil—are shown in the chart of Fig. 4.

Very small or thin parts of water-hardening steel will not only harden in oil, but are often hardened more perfectly that way because they will be stronger. On the other hand, parts of heavy cross section made of steel that is supposed to be both water- and oil-hardening are usually quenched in water because they will be harder. The best medium for extreme hardness is the brine bath, made by adding about 5 lb. of common salt to each 10 gal. of water. Brine is almost always preferable to water in casehardening. It will not produce good coloring, but many cases of "rubber skin" can be avoided through its use.

In most cases, water for quenching should not be allowed to have a film of grease or oil on top, as at *A*, Fig. 5, because even a light coating of this kind will prevent some steels from properly hardening. On the other hand, a layer of oil an inch or so deep, as at *B*, may occasionally be used on top of the water bath with good success in treating "cranky" parts of high-carbon steel, or steel that is both water- and oil-quenching. Such a combination bath tempers the sudden chilling of the water and extracts the heat more rapidly than oil would alone.

The reverse procedure is that at *C*, Fig. 5, of first immersing a part in water or brine, and then transferring it to oil to cool. This method is often useful in casehardening parts that might otherwise warp badly, like the parts at *D*. The water quench explodes the liquid hardening compound on the part and produces a very hard skin while the oil extracts the remaining heat.

The size of the bath must be large enough to keep it from heating up rapidly as piece after piece is quenched. As indicated at *A*, Fig. 6, this is a point of no great significance with oil, but it is highly important with water or brine. A satisfactory temperature for a water or brine bath is from 40° to 60° F. What is likely to happen with higher temperatures is shown at *B*. Practically all steels refuse to harden properly when the bath temperature rises near body heat, or about 100° F. These facts will explain why trouble frequently occurs in the last pieces of a batch that is being heat treated. It is a simple cause, and though not the only possible one it is entirely sufficient to account for the trouble.

Variations in the temperature of the quenching bath, however, may be turned to good account by the exercise of correct judgment. Large, heavy work with deep holes and recesses that require a stiffening and wear-resisting hardness rather than the hardness of a keen edge may be quenched in warm water and thereby kept from developing dangerous stresses.

Tepid brine often gives a better hardness with less strain in the steel than could be obtained through the use of extremely cold water. Indeed very cold water and brine are the bane of intricate and sensitive parts and work of varying cross section. The chill should always be taken off the bath before quenching work of this kind.

Examine Fig. 7 closely; it illustrates a use for boiling water that will often save an immense amount of grief by preventing hardening strains, cracking, and spoilage. Boiling water may be used as a transfer bath after oil, brine, or water-quenching. While the work is heating, a good sized pot of water is brought to a boil near the quenching tank. As soon as the work has been quenched to where it will still cause a drop of water to evaporate quickly, it is dropped into the boiling water.

Heavily wrapping the piece while still warm in paper or cloth as at *B*, Fig. 7, or covering with lime, ashes, or sand, as at *C*, are all good, and better than allowing the work to get cold in the bath. Hot oil also may be used, but boiling water is better, since it can add and subtract heat, and because it can never get too hot to do harm.

In an article to follow, Mr. Simon will conclude his discussion on the art of quenching.

FIG 5

FIG 6

FIG. 7

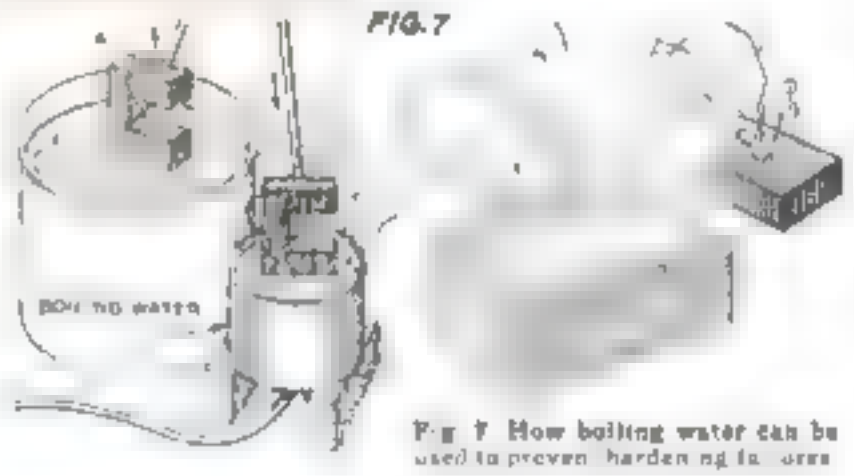


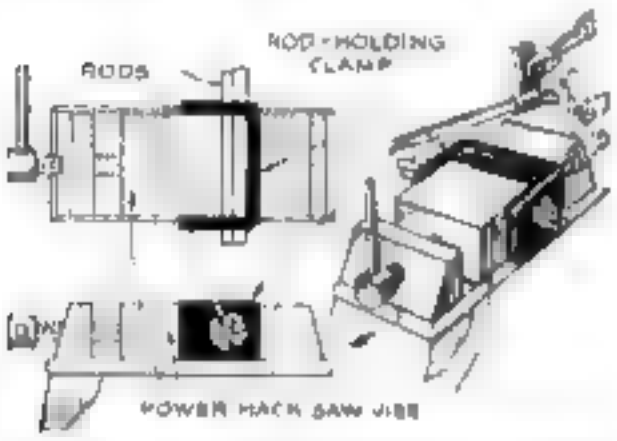
Fig. 7. How boiling water can be used to prevent hardening strains

Tips *from* Five Expert Shop Men

ROD STOCK CLAMP FOR POWER HACK SAWS

A SIMPLE jig for holding several rods of stock in a hack saw vise can be made from ⅛-in. strap iron as illustrated. The strap iron is bent at each end so as to fit the movable jaw of the vise, and a hole is drilled at the back of each bent-over portion as shown

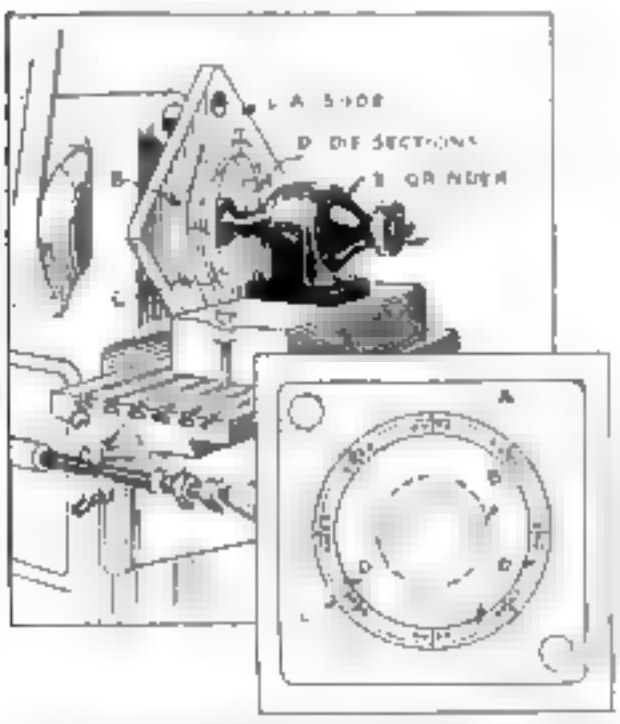
This type of stock holder has the advantage of allowing stock of different diameters to be held tightly in the saw vise. The writer has clamped as many as five rods, all of different diameters, with this vise attachment.—H. Moore



Several rods can be held in the power hack saw vise at the same time with this clamp

RIGGING A MILLER FOR LARGE LATHE WORK

IN EVERY small machine shop an occasional job is encountered which is beyond the capacity of the available lathes. The work often can be done satisfactorily, however, by using a horizontal milling machine. Equipped with a faceplate, the miller can swing a larger piece of work than the average lathe because the knee can be lowered and in most cases the table can be moved out far enough to clear the work. The cutting tools are bolted on parallels at the proper height, and for grinding operations, a portable grinder can be used in the manner shown.



Sketch showing how a miller is rigged for turning work too large for a small lathe

Old Bill *Says*-

ON ACCURATE work, use an expansion reamer to fit dowel pins after the holes have been machine reamed a few thousandths under size.

A good method of drawing the temper of a tap or reamer evenly all around after it has been hardened is to heat a heavy metal cylinder and insert the tool into its very center. This can be done by suspending a wire hook above the center of the cylinder to serve as a rest for the tongs and make it easy to hold the object steadily. If two cylinders are used, one can always be kept hot in the furnace.

In a shop with no compressed air equipment, a tire pump comes in handy for blowing out chips and dirt in machinery and tools.

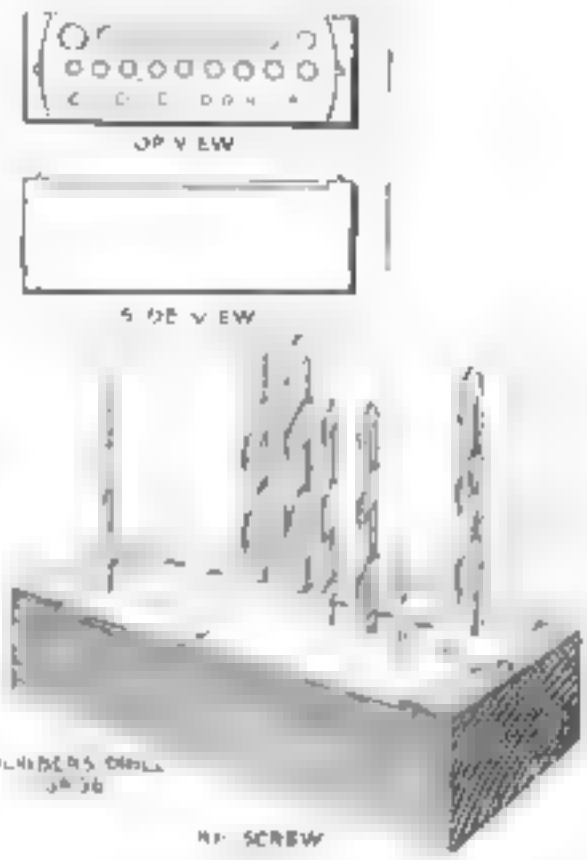
This expedient recently served in one shop for machining a compound blanking die as illustrated. The shoe *A* was fastened to faceplate *B* with four screws and then counterbored as at *C*. After the die sections *D* had been doweled and screwed in place, the sections were ground to the correct diameter with grinder *E*. These operations were repeated in making the punch and shoe

JOBBERS' GAGE SERVES AS DRILL RACK

BY MOUNTING a jobbers' drill gage plate on a block of hardwood, you can supply yourself with a convenient and timesaving rack for the storage of drills.

A piece of hardwood just as wide as the gage is recessed as shown to such a depth that the plate will just fit flush with the top surface of the block. Place the plate in this recess, mark the locations of the holes, and drill each hole with the proper drill. The depth of each hole should be determined, of course by the length of the drill that is to be stored. After the holes are drilled, replace the plate and fasten it down with two roundheaded brass screws

With this type of drill holder it is easy to pick the exact drill you need, and your drill gage is where you can always find it. This arrangement is excellent for the tool room since the drills can be kept in complete sets. Plug gages also can be stored in this manner.—F. J. Wilhelm

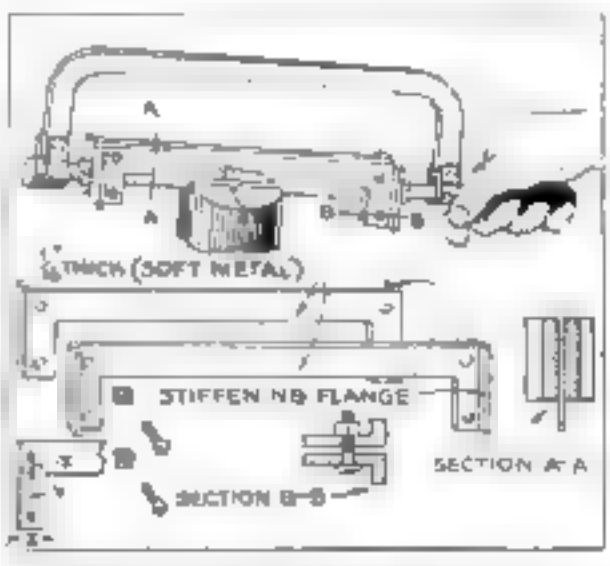


Attached to a block of wood, the jobbers' drill gage serves as a rack for your drills

ADJUSTABLE DEPTH GAGE FOR HAND HACK SAW

A SIMPLE depth gage attachment for a hack saw for use in slotting stock and in cutting metal electrical conduit so as not to injure the inclosed insulation can be made from four No. 6 roundheaded machine screws with nuts and two pieces of 1/16 in. thick soft metal

The distance *X* on the drawings below should equal the width of the blade while *Y* should be equal to the depth of the deepest cut that may be desired. The width *Z* should be about one half of *Y* but should not in any case be less than ¾ in. The flanges, which serve to stiffen the metal, should be at least 1/16 in deep.—Charles A. Pearl



A simple back saw depth gage made from two pieces of metal and four nuts and bolts.

Sadler at his miller, using the LUFKIN "Mike"

TWO FAMOUS "MIKES" -- and Music Filled the Air!

ART SADLER is the genial personality at the left in the picture above. He's shop foreman for the Hammerlund Manufacturing Company at 424 West 33rd St., New York. "I worked in shops all around New England for some years", said Art, "and I came over ago I came into radio with Hammerlund. At that time broadcasting was just beginning, and folks were hearing about a new instrument called the Microphone.

It soon was known as the "Mike"—just like the Micrometer is known as a "Mike". Now you might not think there is much connection between these two instruments, but Sadler soon found himself making the most intricate component that you ever saw, to cut out the many tiny parts which, when assembled in a Hammerlund set, bring the programs in with superb reception. "Some of these fine tools we were making were worth thousands of dollars", said Sadler "and they not only had to be accurate, but on rush schedule.

"When you're working fast many little things can turn out to be great big helps. One of these helps that speeded up the work and kept it accurate was the *large and deeply cut numbers on my Lufkin Micrometer.* Without question it is the *easiest reading Micrometer* you can get, because of the *large numbers on the sleeve, plus each thousandth* also numbered."

Certainly what the Microphone was broadcasting came in better at the receiving end because of what the Lufkin Micrometer did in the shops. Just as the radio was a great step forward, so is the Lufkin Micrometer the *result of inspired modern research.*

Precision tools had been made the same way for years until Lufkin produced improved tools. The Lufkin "Mike" is not only the easiest to read, but is *easier to adjust, better balanced, better finished—and no more accurate tool is made.* Lufkin Micrometers, made in temperature controlled rooms, are scientifically inspected and are guaranteed.

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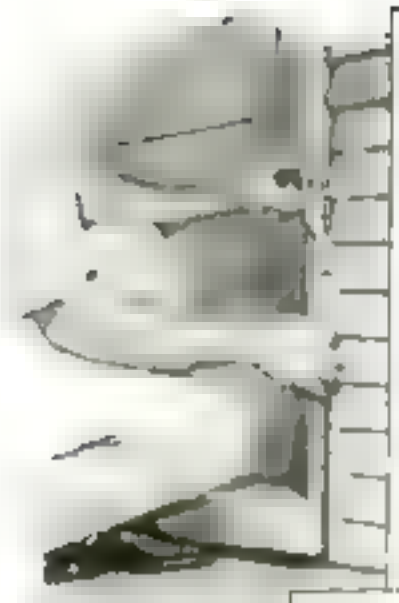
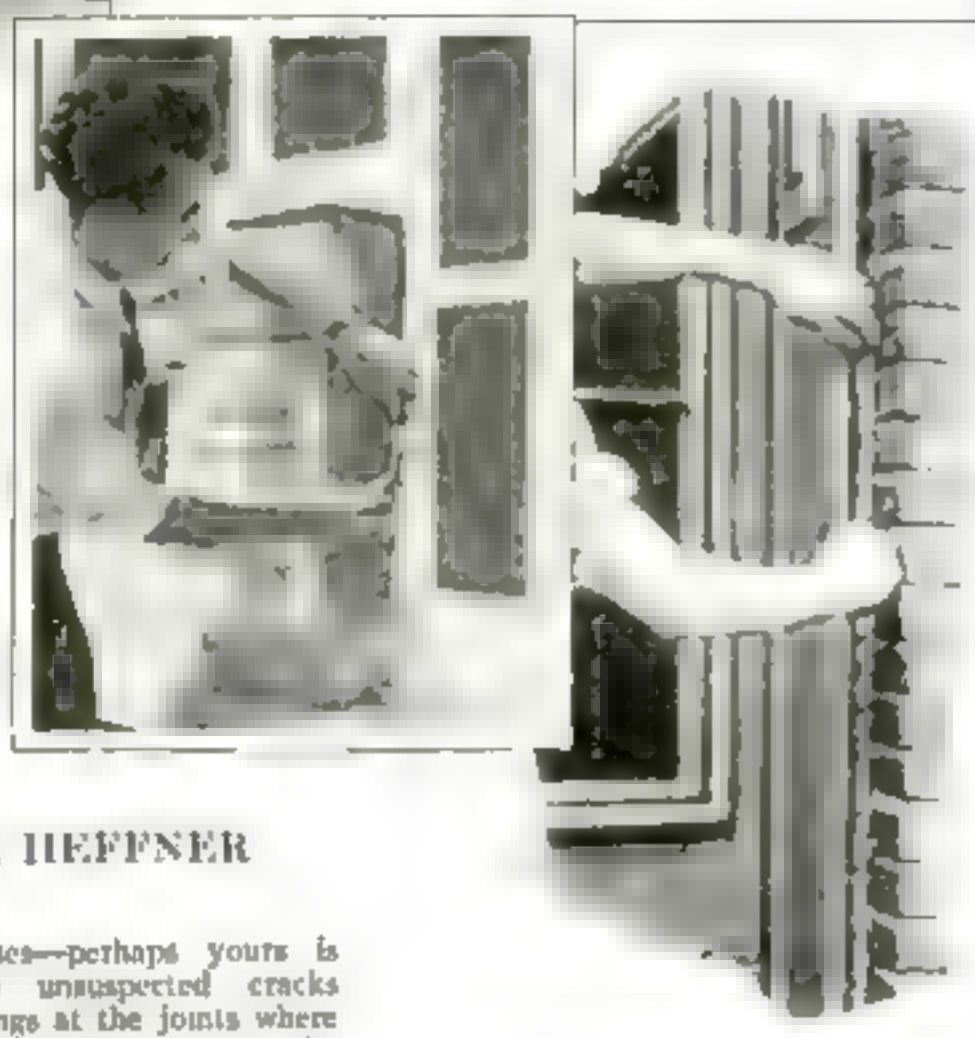


Calking Cracks *around* Window *and* Door Frames



Above Apply the calking compound by working up from the bottom of the crack. A cotter pin puller forms an excellent calking tool

At right Calking coped joints around a veneered enclosure to keep out small insects

At extreme right Working the calking compound well into the opening with the polished face of the knife.

By W. D. HEFFNER

MANY houses—perhaps yours is one—have unsuspected cracks and openings at the joints where the door and window frames meet the exterior wall, whether it is frame, brick, or stucco. The importance of plugging these openings is not generally realized, yet it should be quite obvious that weather-stripping the doors and windows themselves as described in two previous articles (P.S.M., Nov. '30, p. 108; Dec. '30, p. 114) will never be entirely satisfactory if air can leak around the frames by another route

Furthermore, moisture as well as cold air enters through these cracks and often causes the paint to blister and peel in large areas around the doors and windows, and, in the course of time, is likely to rot the wood. If there is considerable leakage of air, the inside walls often bear telltale streaks of dust and soot, and if rain gets in, the damage to the wallpaper or paint may be considerable

Calking these cracks is a simple matter compared to applying metal weather strips. While materials such as putty, mortar, and roofing cement may be used for filling the cracks, they are not wholly satisfactory. Common putty and mortar harden quickly and fall out, and roofing cement smears up the woodwork. It is better to use a specially prepared calking compound, which, while similar to putty in its plastic qualities and ease of application, is far superior in adhesiveness.

A satisfactory compound can be mixed as follows: paste white lead, 6 oz.; dry asbestos, 9 oz.; whiting, ½ oz.; linseed oil, 1 gill (approximately); and enough lampblack to tint the mixture to the desired color. This makes about 1 lb. of the compound, which is ample for the average opening in a frame house. For brick, concrete block, and other masonry buildings, allow about 2 lb. an opening

The formula is a flexible one, and the proportions can be varied considerably. Experiments substituting lubricating oil for linseed oil, or color pigments for lampblack, will prove successful

In mixing, the white lead and asbestos are thoroughly combined and leavened to a soft putty state by the sparing use of oil. The lampblack colors the compound gray and the whiting is added to overcome the objectional stickiness.

READY mixed calking compound in various colors can also be purchased in well-stocked hardware stores. If this type is used in preference to the homemade product, a few hints regarding its use will save considerable time. In hot weather it becomes soft and sticky and is difficult to work. A liberal dose of whiting or the immersing of the plastic in cold water will eliminate this disagreeable feature. In winter the plastic has a tendency to become stiff. Soften it by heating or dipping in hot water

A large cotter-pin puller makes an ideal calking knife if the curved flat face of the broad end is polished smooth and bright to prevent the compound a adhering to it

The easiest method of calking with the knife is first to roll a small ball of the compound in the hands until it resembles a thick string. Then, working upward from the sill, press the string of plastic well into the joint with the polished face of the knife. When one side has been filled, smooth down from the top with a slow stroke. Put considerable pressure on the knife to force the surplus compound to the sides and remove this excess by using the end of the knife as a cutting edge. Finish by smoothing again, this time without pressure, until the filled joint presents an even, glossy surface. Should the compound become extremely sticky in use, add a small quantity of whiting.

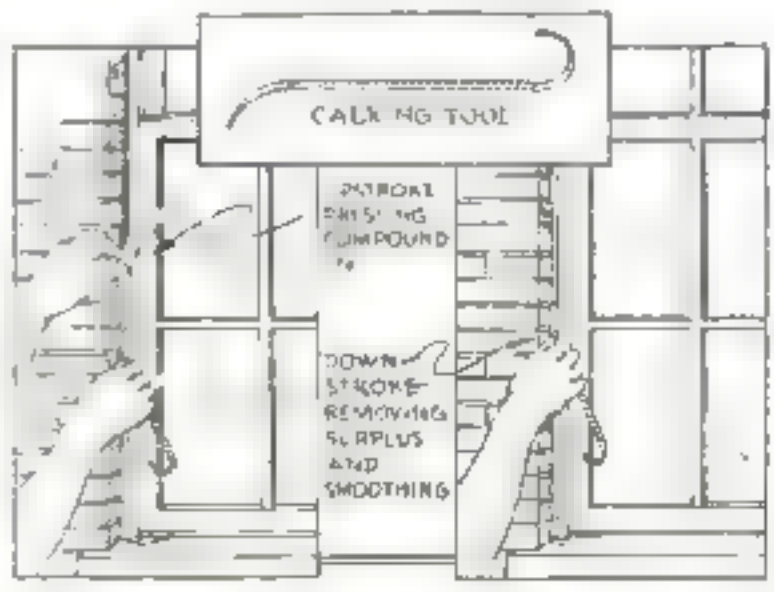
A CALKING gun can be made at home by fitting a tapered metal spout over the nozzle of an automobile grease gun. With this impliement a thinner grade of plastic is needed. To thin the homemade product, increase the white lead and oil content. If the commercial brand is used purchase a grade intended for this use

Work from the top down to the sill, ejecting enough compound as needed to fill the joint thoroughly. No smoothing is done because this type of plastic is so soft that it will spread

In old houses or those which have been carelessly erected, the space in the joint between the frame and wall will frequently be in excess of ½ in. To fill such a space entirely with the compound would prove far too costly. In such a case and irrespective of whether the gun or knife is used it is necessary to provide a base for the plastic. Tamp oakum, waste, rags, or even newspapers in the crack until firm enough to act as a foundation; then calk in the usual manner

Paint should be applied over all calked joints, although it is not imperative that this be done at once.

A complete index of our Home Workshop material published during 1930 has been prepared (see page 92).



The two operations in calking a crack. At left, pushing compound into the opening; at right, smoothing it

BLUEPRINTS FOR YOUR HOME WORKSHOP

TO ASSIST you in your home workshop, POPULAR SCIENCE MONTHLY offers large blueprints containing working drawings of a number of well-tested projects. Each subject can be obtained for 25 cents with the exception of certain designs that require two or three sheets of blueprints and are accordingly 50 or 75 cents as noted below. The blueprints are each 15 by 22 in.

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Send me the blueprint, or blueprints, I have underlined below for which I inclose.....

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This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 8.

With the right brush, rightly cared for,

You Can Do Your Painting

Easier Quicker Better

By G. H. VAN WALTHER

BUYING brushes presents to the amateur painter a problem somewhat similar to the proverbial "cat in the bag." Indeed, even experienced workmen encounter difficulty in judging the wearing and finishing qualities of new brushes.

When cleaned and dry brushes should be carefully shaped and wrapped in paper to keep them free of dust and grit.

Brushes should be used with care. Turning a brush sideways to make a narrower stroke will soon wear away the corners on the bristles.

Usually the professional painter does four things: he buys from a good dealer, uses only brushes manufactured by companies which have a national reputation for quality, subjects each brush to a few simple tests before buying it, and lastly tries to prolong the life of his brushes by careful use and systematic care.

In judging a paint brush, examine the bristles carefully. A good-grade hog bristle brush can be identified by spreading the bristles and looking for the small "flags" or branch stems at the working end. It is these little ends or hairs that spread the paint evenly over the surface and also determine the paint-holding capacity of the brush.

A small oval brush is especially suited for close work.

The manner in which the bristles are held in the handle is another item of importance. Good brushes are set in hard rubber or a chemically inert cement, or are held by compression supplied by a strap. Bristles held in by plain cement which is soluble in alcohol cannot, of course, be used in shellac, lacquer, or any other similar finish containing alcohol.

All brushes, good and bad, will shed bristles when they are first used. The good brushes, however, have only a few loose bristles that can be worked out by hand, while the poorer grade are likely to shed bristles for their entire life. A good practice is to use a new brush for forty or fifty strokes on a scrap piece of wood before applying it to any specific job. This, together with a thorough finger working before it is first dipped into the paint will remove all the loose bristles. If the brush continues to shed, you might just as well not use it.

Amateurs often find brushes that did not shed when they were first used begin to shed after a few painting jobs. This is generally caused by the fact that care was not exercised in cleaning the brush. The old trick of pulling the bristles through a series of nail points driven up through a board to form kind of a rake will often cut the bristles, as will a putty knife or other sharp implement when used to remove hardened paint.

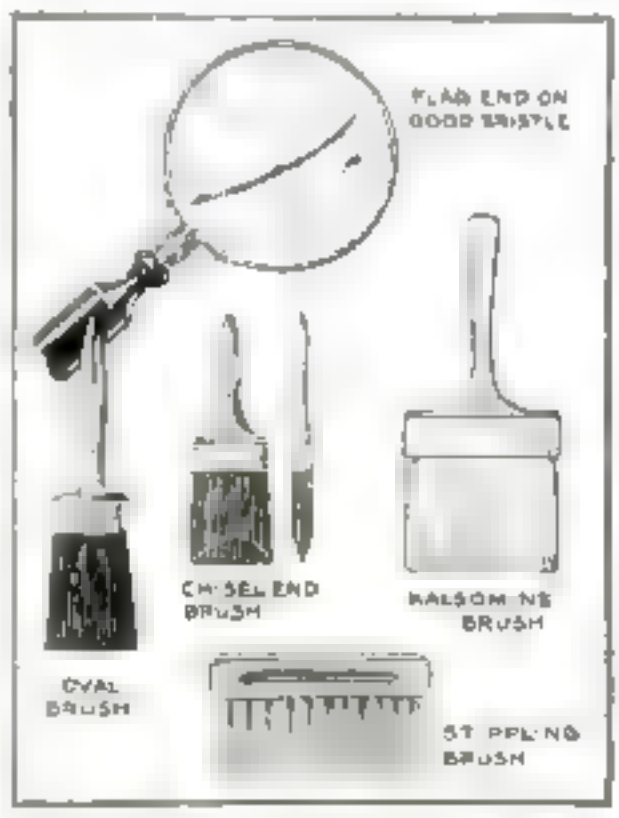
Flat brushes are sold in two general shapes—square ends and chiseled ends. The chisel-end brush is used for applying varnish, enamel, and lacquer, since it tends to allow the finish to flow on the surface rather than to spread it on. Paint should be spread on, therefore, the square-end brush serves in that capacity.

Brushes should be used with the same amount of judgment as would be displayed in the use of chisels. If you are doing large work, use a wide brush; if you are doing small work, use a narrow brush. Oval and round brushes are especially suited for small work such as sashes and narrow trim, and they have the added advantage of having a large number of bristles within a limited width.

Best results with varnish, lacquer, and enamel can be obtained with the soft bristle type of brush which usually is made up of either fitch, badger, camel, bear, or ox hair.

Keeping brushes in condition is mainly a question of careful cleansing immediately after each period of use. Paint-brushes should be thoroughly cleaned in turpentine, gasoline, kerosene, or benzine. Varnish brushes may be cleaned in benzine and then in turpentine, or in a mixture of one part turpentine and two parts gasoline. Brushes that have been used in shellac are cleaned with wood alcohol or denatured alcohol. Lacquer brushes, which should be used for lacquer only, are cleaned in lacquer thinner. Kalsomine brushes are cleaned in warm water and should be hung up to dry afterwards. Never start a kalsomining job with a wet or damp brush. All clean brushes should be shaped and wrapped with paper after they are dry in order that they may be kept free of dust and grit.

A paintbrush can be kept in condition overnight by hanging the brush, by means of a rod passed through a hole in the handle and supported on the sides of the container in linseed oil or a half and half mixture of turpentine and linseed oil. Never stand a brush on its bristles.



Oval chisel-end, kalsomine, and stippling brushes, and an enlarged view showing the flags on the end of a good-grade hog bristle.

WOODEN "SHOES" FOR WALKING ON SKATES

ANYONE who does his skating on a pond or lake where there is no clubhouse or other shelter will appreciate the wooden "skate shoes" illustrated. These make it possible to put on one's skating shoes in the basement of his house and then walk or drive to the ice. It takes but a moment to remove the blocks and the discomfort of having to change shoes

Walking will not dull your skates if you have a pair of these wooden skate shoes on

in the cold, perhaps with nothing but a snowbank to sit on, is entirely avoided

Note that the blocks marked A_1, A_2, and A_3 give direct support to the skating shoe in three places. The base block *B* is cut so that the grain runs across it. Then the skate runner will not cause it to split. The runner lies between the two long blocks *C* and at the rear end passes under block A_3, where it is held firmly. The only other fastening required is a web or leather strap applied as shown

If the tubular type of skate is used, the design need be altered only slightly in order for it to take the tube

Without these blocks it is impossible to drive a car on one's skating shoes, and while one can walk a short distance on the bare skate runners, it is not good practice to attempt to do so because of the danger of dulling and nicking the blades.—C. C. PFEIFFER

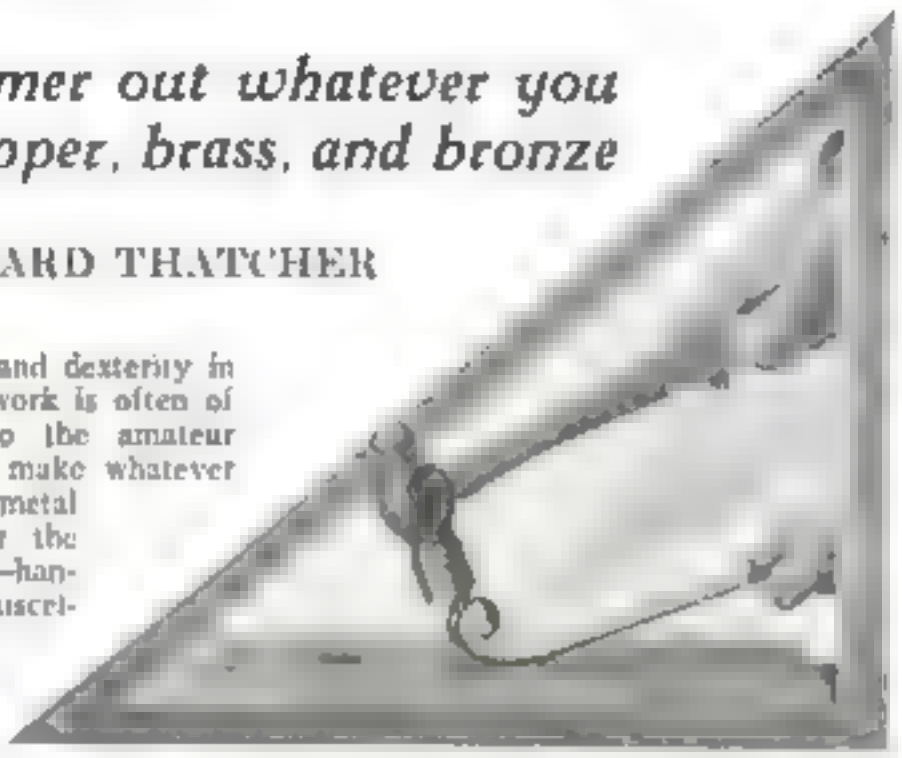
USES SHEET LEAD FOR SHIP MODEL BLOCKS

SHIP model builders often hesitate to begin a new model because the making of blocks and deadeyes from wood is such slow and delicate work. After trying all the methods and materials I could think of I now make the blocks and deadeyes for my models out of sheet lead. The holes are first drilled with a fine drill then the shape is cut out with a sharp knife, and finally a groove is filed around the edge of the deadeye with a three-cornered file.—BILL HUSSEY.

Forging Hardware Specialties

How to hammer out whatever you need from copper, brass, and bronze

By EDWARD THATCHER



The last step in hammering a scroll. As copper, brass, and bronze are forged cold, the work is easier than is generally thought

A LITTLE ingenuity and dexterity in decorative metal work is often of practical value to the amateur mechanic. He can then make whatever special hardware and metal ornaments he needs for the work he has under way—handles, braces, bands, and miscellaneous fittings for furniture, brackets for lighting fixtures, hinges and latches for doors, and a variety of parts which cannot be found in the stock of even well-supplied hardware stores.

Work of this kind, if at all heavy, requires an elementary knowledge of forging. This word has a forbidding sound for those who do not specialize in metal work, but there is no reason why any handy man should have difficulty in making such forgings as the lantern brackets shown in the photographs on page 111—brackets made by the author especially to illustrate this article.

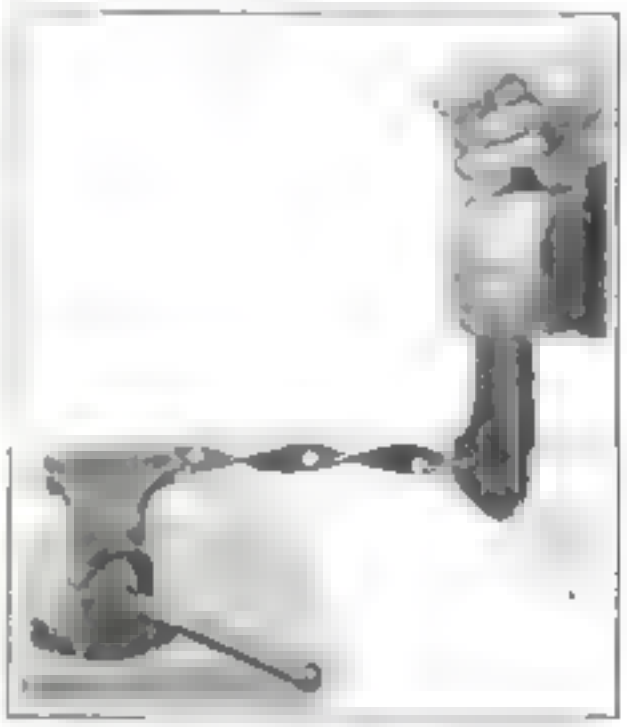
Copper, brass, and bronze, as well as silver and gold, may be forged in the same way as wrought iron, save that they are not forged white hot. It is necessary to heat them red-hot, but then they are quenched in "pickle" (water with ten per cent of either nitric or sulphuric acid added to it) to clean and anneal them before forging. As soon as the metal hardens up from the hammer blows, it is annealed again, and so on throughout the process. Copper and some brass and bronze compositions, it should be added, may be forged at a dull red heat, but this is a matter for careful experiment, and it is generally safer to anneal them first and then forge.

Since copper, brass, and bronze cannot be welded in the fire like wrought iron or steel, forgings of these metals are generally riveted together or held by collarlike clasps or binders. Of course, copper may be welded by the oxy-acetylene torch as may many of the nonferrous metals, but this is work for the expert welder.

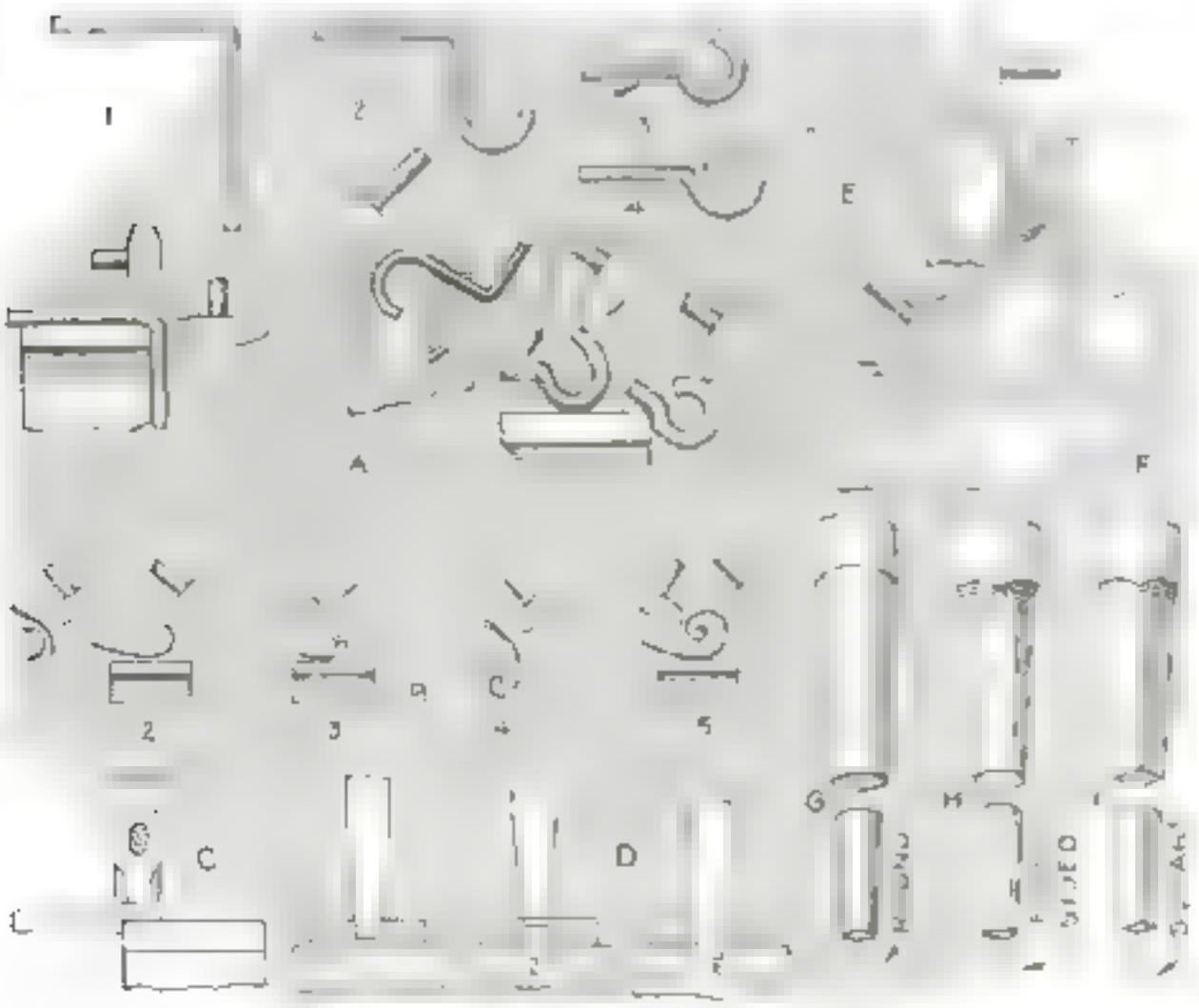
In the home shop, small forgings may be heated by the blowtorch, in a common stove fire, or in a charcoal brazier aided with a hand bellows, and quenched in the regular pickle pot. Larger work requires a regular blacksmith's forge burning coal, coke, charcoal, or gas.

For good work, a very solidly mounted blacksmith's anvil is necessary, although in the home shop small forgings may be done on stakes or on a length of rail.

When making hinges and like forms, it is frequently desirable to thin or taper



How a vise and a monkey wrench are used to give an ornamental twist to a forged bar



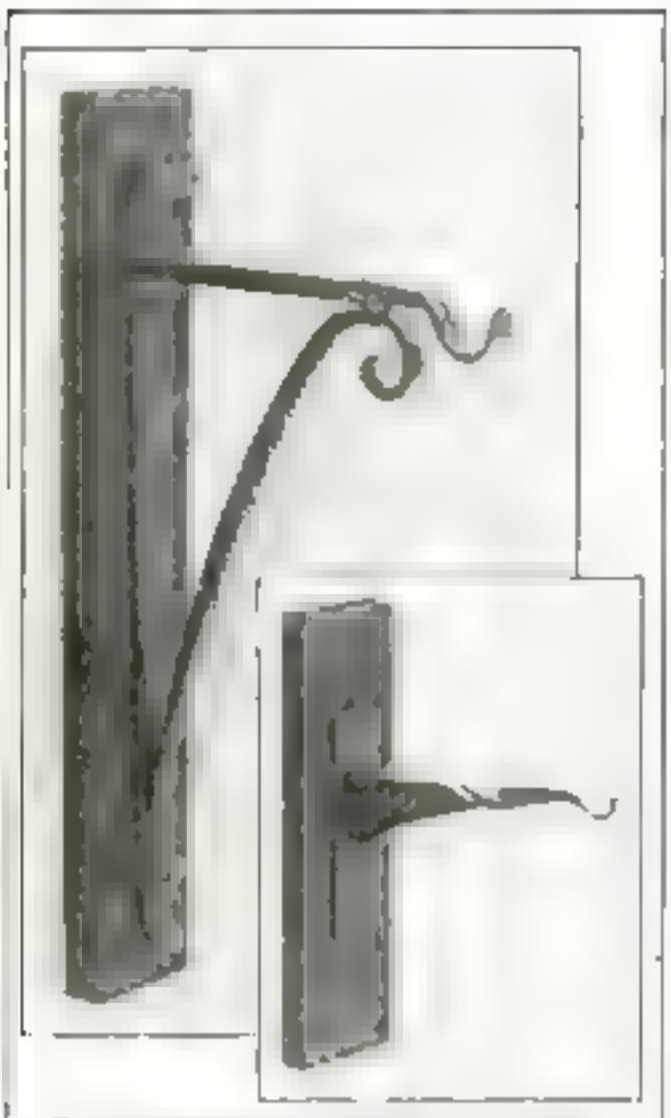
The four stages in bending a loop with hammer and anvil, the steps in making a small scroll, how an offset is formed, the three operations in punching a hole, and how "drawing out" is done

down the metal gradually from a thick, flat bar or a round bar into a smaller section at the end. This is called "drawing out" or drawing down." Properly annealed metal placed on a flat anvil face and struck with a hammer spreads in all directions, but if the piece is to be drawn out longer but not wider, it is placed over the rounded horn of an anvil, at right angles to it and struck with the hammer as at *E* in the accompanying drawings.

The forging is always started at one end and worked back toward the thicker part. The work is frequently annealed and occasionally placed edgewise on the flat anvil surface and trued up by hammering. After the work is sufficiently lengthened or tapered, it is placed on the flat anvil and smoothed up with the hammer. The metal should be annealed a number of times during these operations.

During all drawing-out operations the smith keeps his work constantly squared and trued up so that it will not get too far out of shape. It frequently happens that the work becomes irregular or diamond shaped as at *F* (all references are to the drawings). This should be remedied at once. To square up the work, the hammering should be done carefully and in such a direction as to force the metal back into a square.

When round bars are to be drawn down or pointed and are to be finally round in



Two forged lantern brackets which represent a type of fitting any craftsman can make

section through the entire taper or point, the stock is first drawn out square as at *I*. Turn the bar from side to side as it is hammered. Next, the corners of the squared section are hammered down, making the taper eight-sided as at *H*. Finally, while the work is constantly turned, it is tapered with light blows to a round section throughout as at *G*.

Bending is usually done over the rounded horn of the anvil, sometimes aided with squeezing operations in the vise. The steps in forming a loop or eye in the end of a bar are shown at *A*.

To make a scroll, follow the steps shown in *B*. The metal is first drawn out as desired, then the end is bent down to form the inner end. The work is next placed on the flat anvil with the curled end up, and the curl is increased. Again it is placed over the horn, then on the flat face. A good smith can make a perfect scroll in this way. For some bends one end of the work may be placed in the vise, and the jaws of a monkey wrench set at right angles to the work to form curves or angles.

Shoulders in the metal, such as those at the end of strap hinges at the juncture of the leaflike end, are formed as at *C*.

Twisting is a simple and effective method for decorating forged metals. A square or octagonal bar is annealed, one end of it gripped by the vise, and the other end turned or twisted by means of a large monkey wrench. Hammering, bending, or twisting metal will harden it and it should be well annealed for all these operations—and after them if the metal is to be further worked.

Holes may be punched in forged metal with strong, tapering punches, as shown at *D*. The swelling of the metal around the punched holes may add considerably to the decorative effect. Such punches may be either round or square across, but

they must have sharp edges at the angles between the face and side.

Well-annealed work is placed on the flat anvil face and the punch is set squarely in the desired place and struck several sharp blows with the hammer until it all but goes through the metal. The metal is then reversed on the anvil and the punch is set over the hole punched in the other side (the mark being easily seen on the metal). The punch is struck until it comes through, when the work is moved over the hole in the anvil to allow the end of the punch to clear.

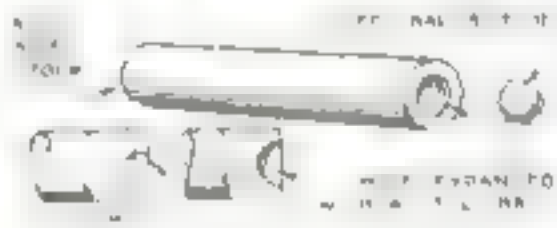
Parts of the work may be upset when necessary. This usually means that one end of a piece is made larger by standing the work on the anvil and hammering down the end, as in riveting.

Forged work may be placed over curved wooden forms or bolsters and driven into them with the hammers or placed on blocks of cast lead to form bosses.

Small work may be sweated together with soft solder, a hole at the riveting or it may be brazed permanently, but usually it is simply riveted. Sometimes the rivets are formed purely on various parts where they are to join other parts. Where the parts are to be held together with rivet-like fasteners it is a good plan to sort solder them first so they will be held while the burners are screwed in place with one of the other sets.

FORMING RIVET SETS

With the aid of a steel ball of the proper size it is possible to make excellent rivet sets with very little labor and at practically no expense. Take a piece of stock of the desired dimensions, drill a small hole in the end for the set



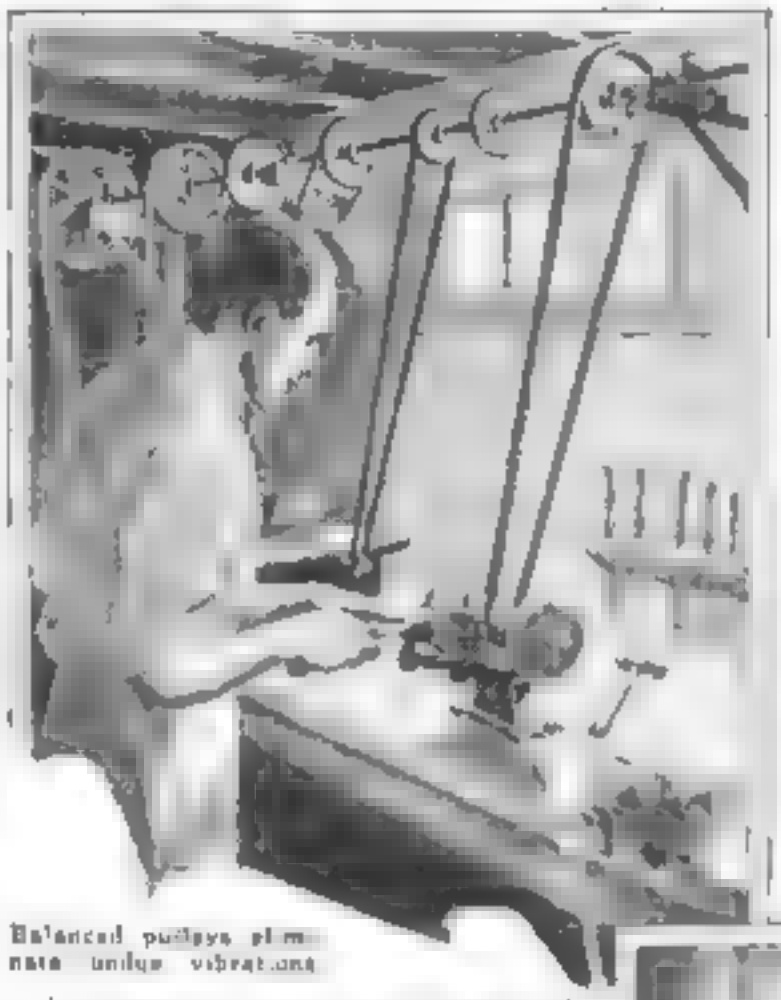
A simple shopmade tool for setting rivets. The depression is formed by a steel ball.

then heat in a forge and while hot strike the ball into the end with a hammer. This will give a true hole in the end of the set. The working end can be case-hardened, or if the tool is to be used much, it may be made from tool steel and hardened.—RICHARD H. KINGS.

CARE OF CHAIN DRIVES

TO MAKE chain power drives last longer there are five simple things to do. First, be sure the sprocket wheels are in line on the shafts. Second, the chain should be run a little slacker than a belt, too much tension causes undue wear on the chain and wastes friction on the bearings. Third, chains should be lubricated at frequent intervals with a good grade of light cylinder oil applied with a paint brush. Fourth, open drives should be cleaned regularly by removing the chain and soaking it in kerosene. Dry well and oil before starting the machine again. Fifth, the sprocket wheels must be replaced when worn.—CHARLES R. WEISS.

Pulley Balancing Made Easy

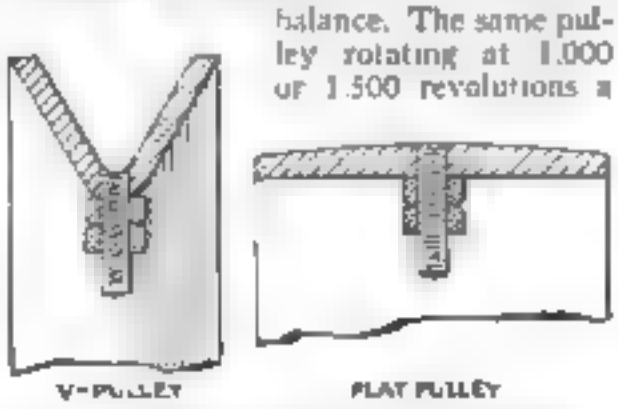


Balanced pulleys eliminate undue vibrations

ALTHOUGH the speed, power and vibrationless operation of the modern automobile is mainly due to lighter moving parts, larger valves, higher compression, and so on these features are made effective only through careful attention to the balance of every running part. Pistons are matched in sets by weight, crank shafts are statically and dynamically balanced Even tires are made to balance the extra weight of the valve stem

The home workshop enthusiast who takes pride in his power-driven machinery will do well to follow in the automotive engineer's footsteps. If you put your hand on your workbench while power machinery is running and you can feel any vibration you may rest assured that some of the rotating parts are out of balance. Vibration caused by unbalanced rotating parts means power going to waste and excessive wear on bearings. Of course, this doesn't apply to a power-driven jig saw, because the necessary up-and-down motion of the saw frame is bound to cause vibration.

The larger the diameter and the greater the speed of the rotating part, the greater the need for accurate balancing. A 6-in pulley such as is illustrated, if turning at 200 revolutions a minute, would cause but little vibration even when badly out of balance. The same pulley rotating at 1,000 or 1,500 revolutions a minute might cause the whole bench to shake



How this simple method of balancing can be applied to either flat or V-shaped pulleys

Balancing any rotating part can be accomplished either by taking off weight on the side that is too heavy or by adding weight on the side that is too light

The illustrations show a way to balance any type of spoked pulley made either for a flat or a round belt. On a table or bench that is solid and steady, place two cigar boxes on end On top of these put two old photographic plates or two similar pieces of plate glass. By means of a level and small bits of paper, get the two pieces of glass absolutely level

Now take the pulley you wish to balance and fit it to a short length of straight shafting and rest each end of the shaft on one of the photographic plates. If the pulley is the slightest bit out of balance, you will find that the heavy side will rotate to the bottom position

Testing a small pulley for balance on two photographic plates that have been accurately leveled

Test it several times to make sure you have found the exact position of the heaviest portion; then drill a hole through the rim at the opposite point, which, of course, will be the point that comes to rest at the top. Tap the hole for any convenient small size of screw—No. 6-32 or 8-32 will do very nicely. Cut off the head of a screw and turn it into the hole so that it comes flush with the bottom of the groove or in the case of a flat belt pulley so that it comes flush with the surface that will be in contact with the belt

Set up the pulley on the glass plates and add nuts to the screw till you find that the pulley will stay in any position with no tendency to rotate The first nut is, of course turned tightly against the inner surface of the pulley to lock the screw in place

Don't be fooled by the fine appearance of a pulley The one shown in the illustration was die-cast from white brass and looked to be a perfect job, yet it required the ¾ in. piece of No. 6-32 screw and the two brass nuts shown to put it in perfect balance. Any ordinary cast-iron pulley unless it is machined all over, is almost sure to be badly out of balance.—F D R

USING STAGECOACH MODELS OUTDOORS

COACH models, now so popular, may be used in simple silhouette form for many decorative purposes. The accompanying photograph, for example, is of an unusually attractive mail box standing outside the country estate of George Brandeis of Omaha. This suggests other uses. A smaller silhouette could be cut out and attached to the front or top of many ordinary wall types of mail boxes such as are to be found beside the front doors of countless houses in cities and towns. On rural delivery routes where the standardized trough-like box is required and the local postmaster is likely to frown on any innovations, a place for the silhouette usually can be found on top of a gatepost, over a bird house, against an outside brick chimney or in some equally appropriate position. However applied, an ornament of this kind, whether it shows a one-horse chaise, a stagecoach or a covered wagon, will give a pleasing touch of individuality.

A cut-out silhouette of a one-horse ornaments this mail box

To make a silhouette exactly like that on the Brandeis box, first draw a full size pattern with the aid of the 1-in. squares. Lay this pattern upon a sheet of heavy gage sheet iron about 9½ by 14 in. and transfer the outline to the metal. Note that a continuous base strip about ½ in. high runs from end to end and connects all objects. Go over the marks with a scriber so that they will not be obliterated during the work, then you can cut out the shape with a cold chisel and dress up the rough edges with an emery wheel where possible and with a file in the hard-to-get-at-places.

The size of the silhouette can be varied by making the squares more or less than 1 in.

A piece of galvanized wire is soldered to the dash, and the other end realistically entwined like a whiplash. Two pieces of light copper wire become the reins, and a heavy wire represents the shafts. A thin strip of tin placed as shown becomes the bellyband—about the only indication of harness equipment that is necessary.

Some attention must, of course, be given to the painting. Certain lines and shadows should be brought out as the photograph shows. You can use bright colors or more conservative ones, as preferred. Gray for the horse will be appropriate, with the gray turning to white for the high-lights and to nearly black for the shadows. Before being painted, the metal should be cleaned with soda water or greatly diluted nitric acid, then washed with pure water and dried. This will insure the paint's sticking. Paint the lower base line green, if you wish, for grass. Give the driver as bright colored a coat as you wish, but make his hat black.—DALE R. VAN HORN

Excellent silhouette designs for a stagecoach and a covered wagon appeared in a previous issue (P. S. M., Nov. '30, p. 94). Ship model designs also could be used.

HOLSTER FOR SERVICE STATION TOOLS

SERVICE station or garage attendants are constantly called upon to use an air pressure gage, a screw driver, and a pair of pliers. Time can be saved if these three items are carried about the person ready for constant use in a holster like that illustrated. Made of well-oiled, soft leather, it is worn upon the right hip, a loop of leather being stitched to the inside of the top surface to allow the wearer a belt to pass through.

The pockets hold pliers, screw driver, and air pressure gage

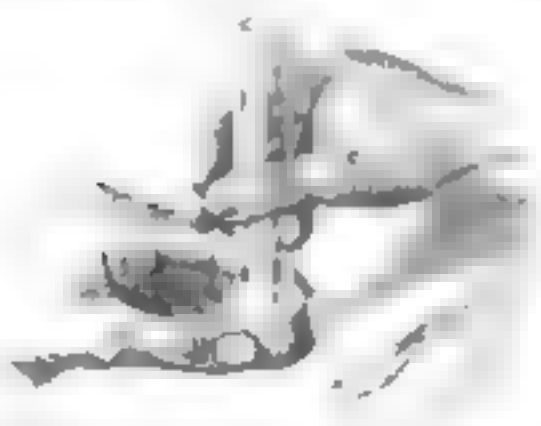
No suggestions should be needed for making it. Simply find a suitable piece of leather and lay the three tools side by side upon it with an allowance for thickness and stitching. Trace the holster outline, cut out two similar pieces, and sew them together, or take the work to a shoemaker and have him do the necessary stitching.

CHEMICAL CRUCIBLES

WHILE one can purchase almost any size and type of crucible from chemical supply houses, it is not always possible, especially in the home workshop, to keep a supply on hand. Excellent substitutes, however, can be made by the amateur chemist.

Scorifiers and cupels as well as crucibles for emergency use can be made merely by hollowing out a hole of the desired size and shape in the face of a soft brick. This type of crucible may be used for anything except assaying.

The same can be said of flowerpots which can be obtained anywhere and come in a large variety of sizes. The only difficulty with this type of improvised crucible is the hole in the bottom, and this can be overcome either by tilting the pot or by plugging the hole with a mixture of asbestos fiber, water glass (solution



A test tube serves as the form for molding a crucible from asbestos, water glass, and sand.

sodium silicate), and sand. Make a dough-like mixture of the asbestos and water glass and add a quantity of sand equal to the amount of asbestos used. After the hole has been sufficiently plugged allow the compound to dry, then place the pot in concentrated nitric acid allowing it to stand for a few hours. Finally wash the pottery in the air.

Small crucibles can be molded from the same asbestos, water glass, and sand mixture, a large test tube being used as the mold for the inside (see illustration).

One part of Portland cement and from four to five parts of sand may be mixed to form a good material for crucibles, and it has the advantage of being liquid enough to be poured into a mold.

Crucibles require a coating of some material to prevent the absorption of chemicals into the pores. A saturated solution of borax, if poured into the crucible and allowed to stand for five minutes, will serve to glaze over the surface and prevent this absorption. Borax and borax glass also can be melted in the crucible and the molten material then washed around on the sides. Such a glaze also prevents substances such as metals from adhering to the sides.—H. BADE.

THE ADDITION of a small quantity of plaster of Paris or red lead will cause common putty to dry harder than normal. A good formula for a durable putty is as follows: ordinary putty and dry white lead (or dry whiting and paste white lead) thinned as necessary with boiled linseed oil and japan gold size or spar varnish.

Hints That Will Help You Build Airplane Models

By EDWIN T. HAMILTON

BUILDING model aircraft has become such a universal hobby that model makers today often find it impossible to keep pace with the many new ideas developed by its multitude of enthusiasts. It would be impossible for one man to collect and catalogue all of these ideas but here are a few that should benefit every builder of model planes

METAL FITTINGS

Music Wire Diameters and Gage Numbers: The diameter of wire is designated by a gage number which is all that one needs to know when purchasing. However, there are times when it becomes necessary to know the actual diameter of the wire as well as the gage. The common sizes ar

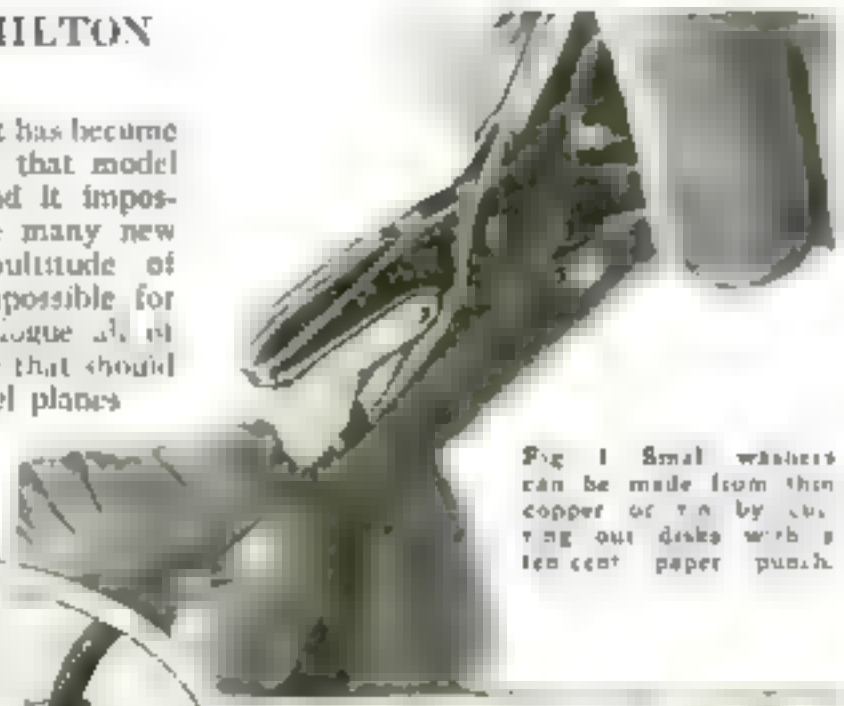


Fig. 1 Small washers can be made from thin copper or tin by cutting out disks with a ten cent paper punch

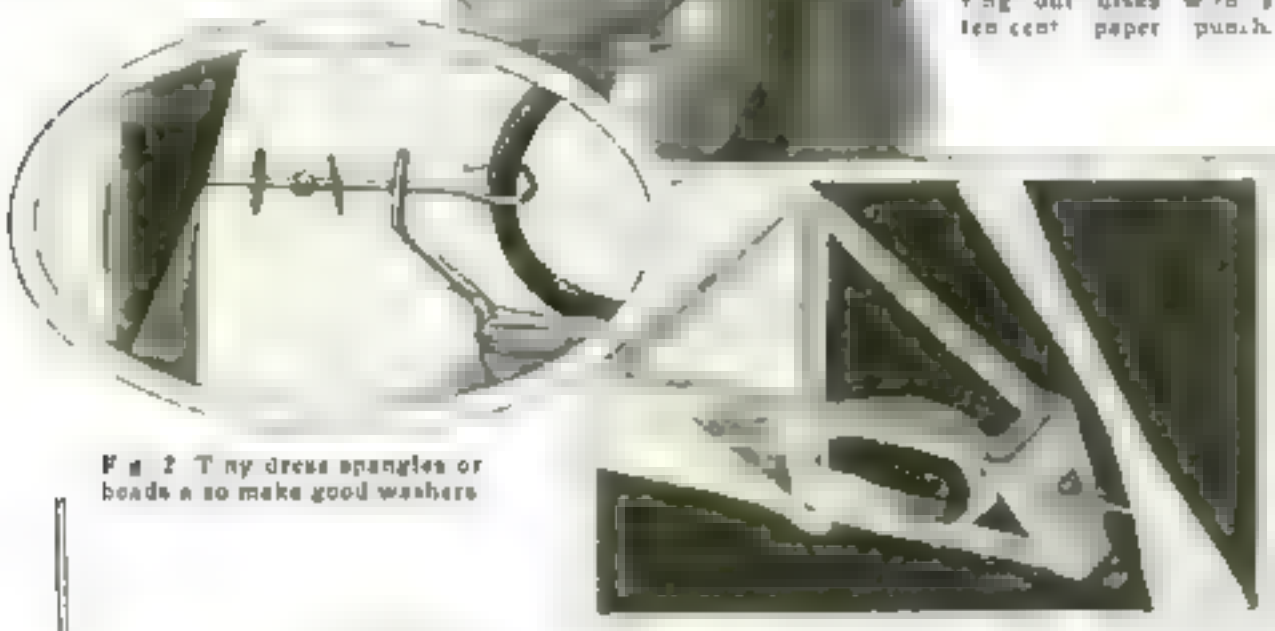


Fig. 2 Tiny dress spangles or beads also make good washers

Fig. 4 A common needle used for a prop bearing

Gage Number	Wire Diameter
6	0.016 in.
7	0.018
8	0.[illegible]
9	0.[illegible]
10	0.[illegible]
11	0.[illegible]
12	0.[illegible]
13	0.031
14	0.033

Propeller Shaft Washers: An easy way to make washers is to use a paper punch

[illegible] washers for propeller shafts. A sponge between two washers

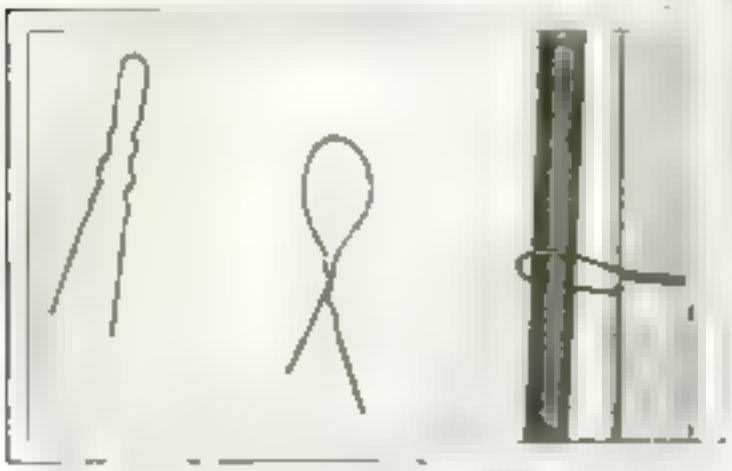


Fig. 5. How to make a "can" or guide for a rubber motor by bending a hairpin and snipping off the ends

Fig. 7 A one-piece wire landing gear which has a second double gage on the motor stick.

will be found the best combination.

Lubricating Washers: To prevent friction rub washers with petrolatum or vaseline. It serves the purpose splendidly and will not run like a drop of oil.

Bent Propeller Bearings: When fitting a three- or four sided fuselage model with a propeller bearing do not use a nail or metal bearing. Cement a piece of 1/32-in. sheet balsa wood to the ends of the longerons after cutting it to conform to the design of the nose of the model (Fig. 3). Pierce its center with a pin and insert the propeller shaft through it.

Needle Bearing: A simple metal bearing, which does away with all drilling, can be made from a needle (Fig. 4). For indoor models use a regular sewing needle about 1 1/2 in. in diameter. For outdoor types, a darning needle will be required. When selecting your needle it will save time if you can find one with an eye large enough to admit the propeller shaft through it, but this is not essential.

The temper must be taken out of the needle before it can be properly bent. Do this by heating it to a white heat and allowing it to cool naturally. Do not place it in water. When the needle has cooled, bend it to the required shape. If too long, it can be cut to any length desired with tin snips. Try the shaft through the eye. If the eye is too small heat it to a cherry red and while it is still red, force the shaft through. The needle must now be retempered. Heat it again to a cherry red and plunge it into a glass of cool water, tempering it until it is a blue color or between a blue and a straw color; but do not temper it too much, as it will become brittle and break.

"Can" Hook: The hairpin "can" hook shown in Fig. 5 is quite simply made. Bend a hairpin to make a loop of the required size, and cross the two ends. When pulled apart, the ends will spring together again. Snap off the ends as desired, spread the ends apart, and cement them to the sides of the motor stick.

"S" Hooks: After attaching the rubber motor close the loop of the hook so that the rubber cannot fall off when the motor is unwound and loose. Wrap the loop with common thread and coat with dope to prevent the wire from cutting the rubber. Small rubber tubing is ideal for this purpose. It can be obtained from any oculist.

Wing Clips: For small stick models the usual wing clips are often weak and

"You folks must think I can't play!"

I cried, when they laughed at my offer

IT was the monthly get-together of our little group. We had met at Tom's house and the fun was at its height. Mabel had just finished singing a touching version of "Frankie and Johnnie" and the room fairly shook with laughter. Then I offered to play.

"Boys! This is going to be good. Did you folks hear what Jim just proposed? He said *he'd play for us*!" cried Tom.

I pretended to be highly insulted. Drawing myself up with mock dignity, I said "You folks must think I can't play! Why, the very idea!"

This caused a fresh explosion of laughter. "Can't play," called someone. "Say, if I could play as well as you I'd be digging ditches right now."

That was too much. Seating myself at the piano I held up my hand to command silence. Then, with a good many flourishes and turning of pages, I opened the "Collection of Southern Songs" at "Swanee River," turned it upside down, and began to play.

And how! My usual one-finger clowning was as nothing compared to the performance I put on now. It was masterly. I traveled up and down that keyboard with my one good finger, as Tom called it, until the crowd howled for mercy. Finally I stopped, turned around and demanded.

"Now who says I can't play?"

"You win!" came from all sides. "Only please don't demonstrate any more, for the love of heaven!"

But instead of getting up from the piano, I suddenly swung into the haunting strains of "The Pagan Love Song." But with a difference. ...

How I Taught Myself To Play

And so I told them the whole story. ... The ad had offered a Free Demonstration Lesson to prove how easy it is to learn to play at home without a teacher in one's spare time. ... But I never expected that it would be as easy as it actually was.

That's why I sent for the entire course. ... I learned in my spare time, after work, and enjoyed each lesson as much as if it had been a delightful game. For there are no long hours of practice—no tiresome scales—the U. S. School ... was as easy as A-B-C.

... I was sure of myself, you know ... Well, what do you say?

They ... developments. ...

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This story is typical. People who ... thanks to the U. S. School of Music ...

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unsteady. This can easily be remedied by bending a small saddle (Fig. 6) at the bottom of the rest, which allows the clip considerably more purchase

Landing Gear: The usual one-piece landing gear of wire often causes a crash because the single wire makes such a narrow connection with the motor stick. If a short extension is bent on the top of the landing gear as shown in Fig. 7, it gives two places of contact on the motor stick and therefore holds solidly in place. This idea was submitted by P Schiavone

Combination Rear Hook and Tail Skid Figures 8 and 9 show a single wire which serves well as a rear hook and tail skid for single-stick tractors

WOOD BENDING

Bamboo: Bamboo has always presented a problem to the model builder when he attempted to bend it The usual process of bending it over a candle has often resulted in burned or scorched wood. Try bending it over a hot electric iron (Fig 10) Lay the bamboo over the point of

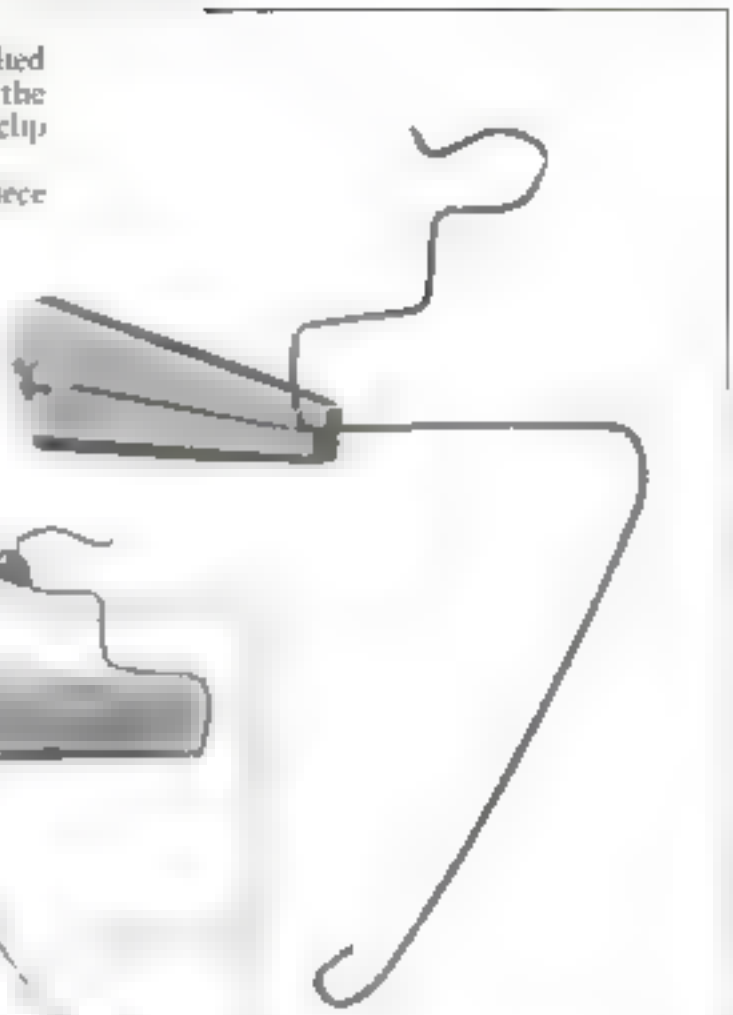

Fig. 8. Using a single wire for rear hook and tail skid.

Fig. 9. The combination hook and skid on the motor stick.

wish to make the bend. The iron will not burn or scorch the bamboo yet it will make it pliable en

ough so To obtain ex

cellent results in balsa wood l

ways been a difficult job

rks that have been

boiled in water to the spots where you wish to bend to your heart's de

sire (Fig 1

Laminated Balsa Parts: When the model has been assembled, rudders and wings often need adjusting This is usually

the part to be strung t

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12 By squeezing the

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wood without affecting

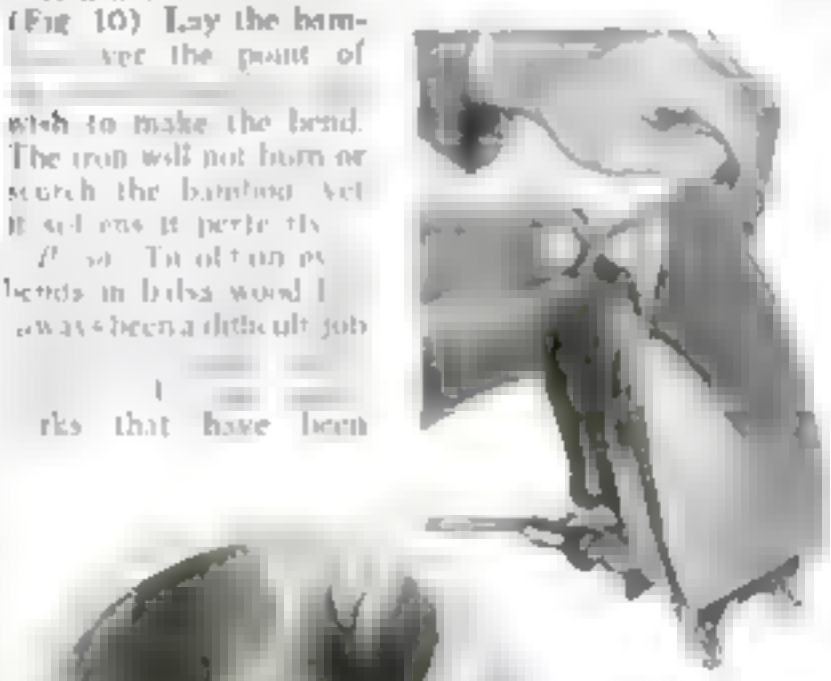


Fig. 11. The best trick for bending

soaked in boiling water

disturbing other parts

adjoining parts, and the wood can be easily bent.

A Curved Dihedral Angle: Many model builders like the appearance of a curved dihedral angle in their wings. Try this Taper your wing spars from the center toward the ends instead of using wing spars of even width and thickness. Construct the wing in one piece. Cover one side only with Japanese tissue, but do not stretch it too much when applying it to the structure. Moisten the entire surface with a damp sponge, taking care to moisten each half evenly. This will warp the spars in a curve. With a model of ordinary size it is possible to obtain a dihedral angle of about 1½ in. at the tips by this method

GROWING A MINIATURE GARDEN INDOORS

A REAL indoor garden on a small scale can be grown during the winter in a window box or fernery filled with soil

Make a pool in the center of the box by forming a circular depression in the soil about 6 in in diameter and 6 in deep, and applying a layer of cement. Sink a small

A house, trellises and other bits of greenery can be easily fashioned from cardboard.

drain pipe below the surface of the cement and carry it out through a hole bored in the bottom of the box, and use a cork for a stopper At one end of the box on a slight mound, erect a small model of a house

Trips to the woods and florist will furnish many interesting varieties of dwarf ferns, flowers, and evergreens for use in the garden. Set miniature pines and cedars or other evergreens about the grounds for trees and shrubbery The rockery may be made realistic by planting moss, tufts of grass, and flowers to peek out from beneath the rocks

Care must be taken that all plants have sufficient roots, so that the garden will remain fresh and green all winter. Dwarf varieties are preferable, although the garden illustrated contains only the commonest plants.—MOZELLE PAYNE BEAM.

Resawing Boards Thinner

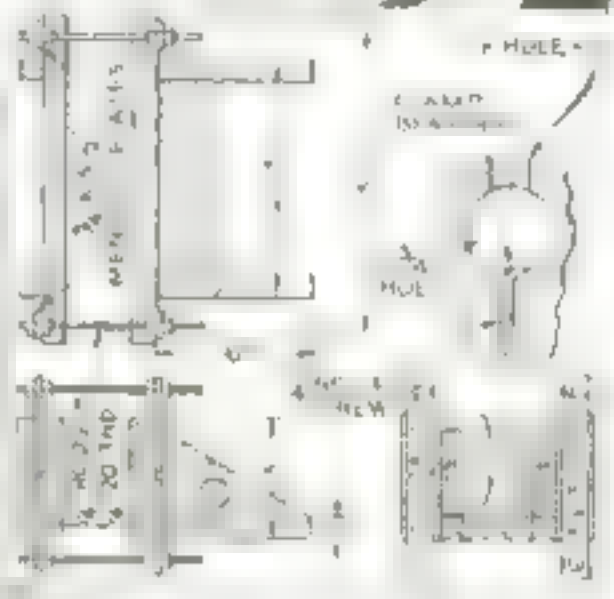
By JOHN M. CHITTENDEN

How many times have you required a thin board and found that your local lumber dealer had nothing you could use? No longer need this common difficulty bother you if you own a small band saw, for you can cut stock to any thickness you wish with the aid of the resaw fence described in this article.

An easily made fence for resawing stock on a bench type bandsaw

EVERY home craftsman often needs thin boards or a small piece of veneer. As the thinner sizes of material are seldom stocked by the average lumber mill, it is necessary to resaw the thicker sizes or send to a lumber specialty firm for them.

Resawing can be done on a small circular saw to a depth of about 4 in. by ripping one face, reversing the piece, and ripping from the opposite edge. This method, however, requires more power than is generally available in the home shop, and the saw blade is apt to be badly burned. It is much better to do the resawing on a band saw by using a special fence made as shown in the accompanying illustrations. The dimensions given are for a saw with a table 11 by 12 in. but they can be altered as necessary to suit any small commercial outfit.



Top, front and partial side views of fence, and the clamp bearing

The device consists of two fences. One is clamped to the saw table with its face at a distance from the blade equal to the desired thickness of the resawed stock. The other fence is attached to the first with four bolts, one in each corner, and it is adjusted by means of these so that the faces of the two fences are exactly the same distance apart as the stock to be resawed is thick. If more than one cut is to be made, the second fence can be moved, after the first cut, to the thickness of the remaining stock, and the operation repeated.

The fences are made of ¾-in. stock throughout and fastened with butt joints, which are glued and screwed. All screws on the faces of the fences should be countersunk and the holes filled with a wood composition. The faces should be smooth to allow the stock to slide easily.

The stationary fence is clamped to the table with two small C-clamps. A ¾-in. hole is bored through each of the side-pieces as shown and a ½-in. hole is counterbored from the top to allow a ¾ in., No. 14 flathead screw to be driven vertically into the wood to give a bearing surface for each clamp.

Eight ¾ by 3½ in. mending plates and

A small band saw with the special fence set up for ripping thin boards from thick ones.

four pieces of ½-in. rod are used to hold the fences apart. One plate is screwed to each of the four corners of both fences. Take care that one hole in each plate lines up with a hole in the facing plate so that the rods will run through squarely. These holes will probably have to be reamed slightly to take the rods. The rods are threaded with a standard ¼-in. No. 20 tap, and each corner is securely held with double nuts as shown.

Stock up to 5½ in. thick can be resawed with this attachment, and if the fences are correctly set a perfect job will result. It is advisable to use the widest blade available provided, of course, that it is within the capacity of the machine.

EASILY MADE DRESSING TABLE FOR A BABY

TO MAKE it easier to dress a small baby, I built the canvas folding table illustrated. It is 38 in. high and has a 25-in. spread when open.

Seven ordinary wooden dowels are used in its construction. Four of these are 1 in. in diameter; they form the cross

The framework of this folding dressing table consists of seven ordinary wooden dowel rods

legs. Two of them are 4½ in. and are used for the side rails—the ones upon which little David is resting his hands. The seventh, which is only ½ in., is used as a spreader between the two pairs of legs.

The parts are screwed together. The screw which joins each pair of legs passes through into the end of the ½-in. dowel used as a stretcher. The iron brace at each end is a strip of metal ⅜ by 7 in. fastened with screws to the crossed legs for the purpose of keeping them apart. One end of each brace is slotted to allow it to be swung away from the screw when it is desired to fold the table. The top is of white canvas tacked on the side rails. The total cost was 25 cents for 1 yd. of canvas 36 in. wide, 7 cents each for the smaller dowels, and 10 cents each for the four large ones.—MARSHALL BREEDEN

Unlike many similar pieces, this cabinet is genuinely attractive as well as useful.

Concealing the Telephone

By HERMAN HJORTH

THE telephone cabinet illustrated not only has a closed compartment for concealing the telephone and two easily-accessible pigeonholes for the directories, but, unlike so many commercial cabinets intended for the same purpose, it is a genuinely attractive piece of furniture. If you are at all handy with common tools you can build this cabinet from materials costing well under five [illegible]

[illegible] and wood such [illegible] Black walnut, birch [illegible] sweet gum should be used in the construction. The following [illegible] lines of construction and order [illegible] of processes are suggested.

Saw the four legs approximately to length, thickness and width leaving stock for squaring. Square two adjoining sides on each leg first, then set the marking [illegible] to the thickness and [illegible] mark and gage all four legs. Plane the legs to the lines, place them side [illegible] a line across at the other end, and saw on these lines, using a miter box so that the cuts will be square.

The two sides are then squared to the exact dimensions. If the stock was planed at the mill, it is not necessary to hand plane the faces at this time.

If a small power saw is available, it is easy to make the leg joints as shown in the detail drawings at the bottom of the page. This is called a groove and rabbet joint or a bateface-tongued joint. Set the circular saw ⅜ in. over the table and cut the rabbets on the sides first. Place the legs together in the position they are to occupy, marking their ends respectively R. F. (right front), L. F. (left front), R. B. (right back), L. B. (left back). Be sure that the two inside faces of each leg are exactly square to each other. As an added precaution, mark all the outside faces "out." In this way there is less chance of making a mistake in cutting.

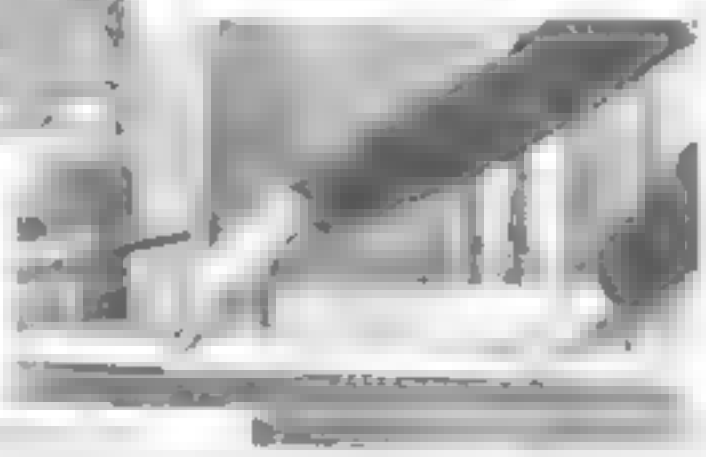
Lay out the grooves on the legs and square a pencil line all around each leg at the lower extremity of the groove. Do the cutting with the circular saw a shade higher than ⅝ in. over the table. As it is essential to hold the outside face of each leg against the ripping fence of the saw and as the legs must be made in pairs, right and left, the grooves in two of the legs are started from the end (or top) and stopped in the middle, and those in the other two are started in the middle and finished at the end. To do this make two chalk marks on the ripping fence or on the table of the saw to show the length of the projecting saw blade (see the photographs). These are guide marks showing where to stop or start cutting.

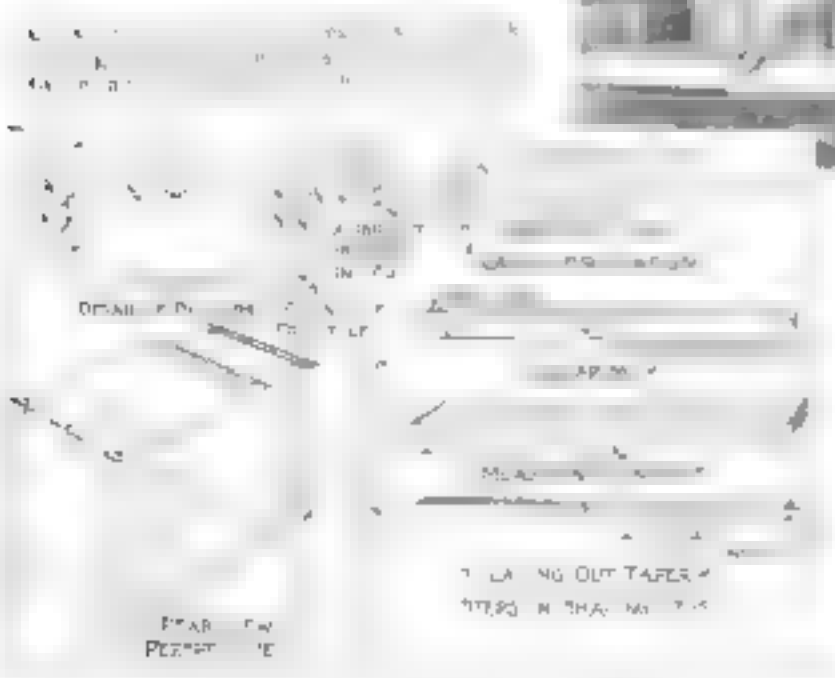
AFTER making one saw cut on all four legs, move the ripping fence of the saw to the width of the groove and make another saw cut on all four legs. Any wood left in the center of the groove may be removed with a third saw cut. Fit the sides into the grooves and lay out and saw the rabbet for the back on the two rear surfaces of the back legs.

If the sides and legs must be joined by hand, the rabbets and grooves can be planed, of course, with special grooving and rabbet planes. Another way of joining them is by means of dowels. The method of laying out the legs for the dowel holes is shown in one of the drawings.

It is now time to taper the legs. The reason this operation was not done earlier is that the legs are easier to lay out and cut while they are of the same dimen-

The grooving cuts on two legs begin at [illegible] and when the mark on the leg coincides with first mark on table





How the legs are laid out, detail of bottom, and a perspective showing how legs, sides, top and bottom are assembled

Bill of Materials

No. of		T.	W.	L.
4	legs	1¼	1½	30¾
2	sides	¾	8½	14¾
1	bottom	¾	9¾	17
1	lower top (plywood)	¼	10½	19
	partitions	¾	9¾	14
1	top	¾	10½	20
1	back (plywood)	¼	14¾	17¾
1	door	½	9¼	14

1 pair fast joint butt hinges, 1 in. wide when open, 1¾ in. long
1 ball catch.
1 knob (brass)
Inlay according to individual taste

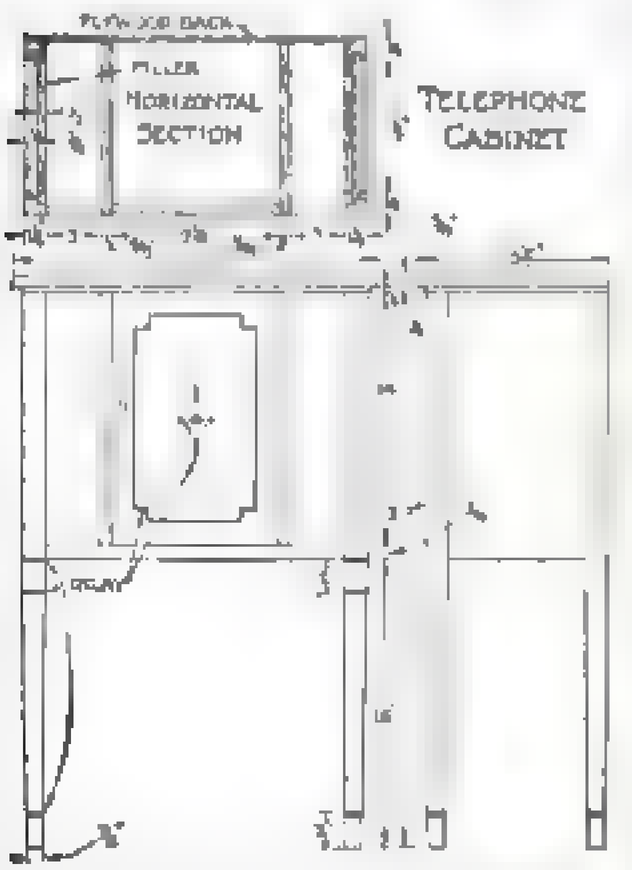
NOTE. All dimensions are in inches

sions throughout. The amount of the taper, 7/16 in. on each side, may be gaged on the end of each leg, and lines drawn from these points to where the taper begins, 14 in. from the lower end (see detail drawing). Plane two opposite faces first, and mark and then plane the remaining two.

GLUE each pair of legs together with their corresponding side. Take care that the clamping does not twist the legs. When dry, plane the outside face of side and legs until they are flat and smooth. Test frequently with a steel square. Make the bottom, notch the legs as shown, and fit the bottom in place. Lay out and bore for two dowels on each side as shown. The two fillers, one on each side, should be made next and glued in place. Make the lower top from a 1/4-in. piece of plywood, letting it project 1/4 in. on the front and each side, but keeping it flush with the rear legs. Bore and countersink holes for screws. Glue the bottom in position, at the same time fastening the lower top in place with screws. The two partitions are next fitted and screwed to the bottom and the top. The plywood back is screwed to the legs and partitions, and the top proper is fastened to the plywood subtop with screws inserted from below.

The door preferably should be made from a 1/2-in. piece of plywood as this is less likely to warp than solid wood. It is carefully planed to fit in the opening, and hinged. It may be held closed with a ball catch inserted either in its lower or upper edge. This type of catch may be purchased in any hardware store. It is fastened to the door by boring a hole of the right diameter and the brass striker is fastened to the door frame with a screw. A brass knob completes the list of hardware needed for the door.

Much is added to the attractiveness of the cabinet if it is inlaid. A design for the inlay is suggested. The same inlay design used on the door can be enlarged and used to decorate the top. The grooves for the inlay on the legs may be cut on the circular saw before the sides are glued.



Drawing of the cabinet. The inlay design is only suggestive and may be varied if desired.

The Secret of Making Long Slender Wood Turnings

By CHARLES A. KING

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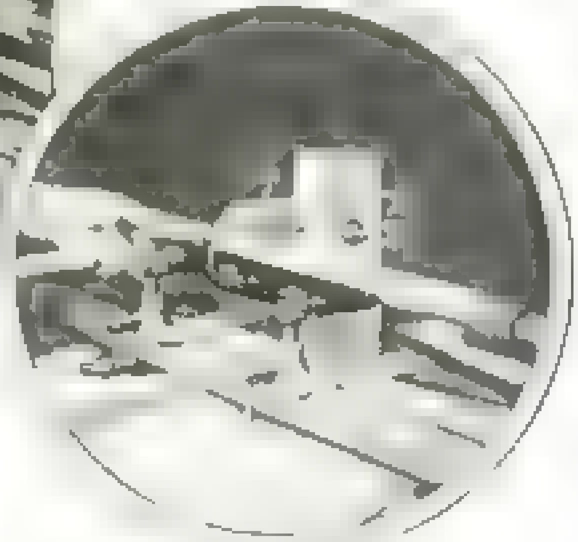


MANY [illegible]

[illegible] matter to duplicate this type of delicate work on any small bench wood turning lathe [illegible] a back rest is made as illustrated.

The accompanying drawing (Fig. 4) gives suitable dimensions of the back rest which is easily made, and the photographs (Figs. 1, 2 and 3) show how it is used. The distance between the top of the work bench and the center of the lathe head stock governs the height of the standard A, Fig. 4, in this case 7 in. The only [illegible]

[illegible] being [illegible] deep in each piece. The follower F moves back and forth as it is adjusted to the size of the turning to. The rest may be fastened to the bench with a clamp as at H and a wedge may be added at J if necessary.

Place the turning, in this case a slender table leg, between the lathe centers and adjust the tool rest. [illegible]

[illegible]

Fig. 3. When the taper is roughed out, the finishing can be done with a sharp plane adjusted for a light shaving.

[illegible] the wood down to a little more than the finished diameter of

the turning at that point, as at *B*, Fig. 1.

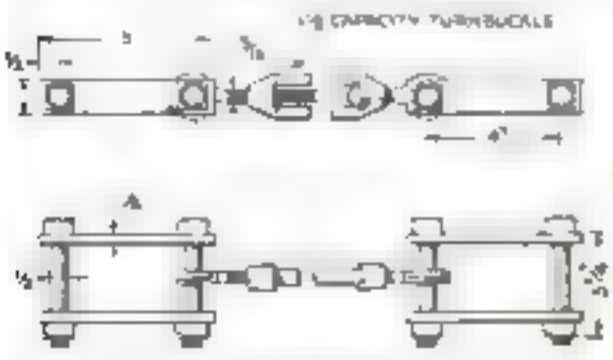
Rub the V-notch in the follower *F*, Fig. 4, with a piece of white wax to reduce burning and scratching, and move the follower until it bears lightly against the turning as at *A*, Fig. 2. Fasten it with the wing nut. Change to high speed and proceed to rough out the turning at *B*, Fig. 2, moving both tool and back rests to right or left as needed. When the piece is roughed out, the tapering may be finished by using a well-sharpened plane as in Fig. 3, but the rests must be moved as necessary to allow the plane to work properly. Then complete the foot and top turnings and sandpaper carefully.

SPECIAL CLAMPS MADE WITH TURNBUCKLES

How this simple and inexpensive clamp can be used in gluing a chair

BY MAKING use of turnbuckles, the amateur craftsman can easily improvise clamps for drawing together parts that are of irregular form or that require the use of some device of greater capacity or flexibility than ordinary hand screws. For example, a pair of clamps made as illustrated were used in building the Spanish leather screen described in a recent issue (P.S.M., Nov. '30, p. 88), but they would be equally valuable for holding together the legs of a chair or table while the glue was drying on rungs or rails that had been reset (see illustration above).

Each clamp requires only some band iron, four bolts, and a turnbuckle. While the dimensions on the drawing give a clamp of wide utility, the same principle can be used in making clamps of any size. The actual cost to the writer for each clamp was about 85 cents.—PAUL LEO



A turnbuckle, four bolts, and some band iron are the only materials needed for each clamp.

This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

OILSTONE RACK SWINGS OUT OF THE WAY

The oilstone and oil can rack swung out for use. A hook at the far side holds it open.

THREE pieces of scrap wood, two hinges, and a hook and eye are all that are needed to construct the convenient oilstone and oil can rack illustrated. The rack is mounted so that its top surface is about bench high. When not in use it can be swung back against the wall, out of the way.—ROBERT W. MINER.

NO DOGS CAN GET INTO THIS GARBAGE PAIL

SUPPORTED on a stand made of pipe as shown, a garbage pail is held so high that no hungry dog can get at the contents, and the wind cannot blow the cover off because it is weighted down with a heavy cap from an automobile wheel attached to a chain anchored to the brick wall.

To make the support you will need ten pieces of ¾-in. pipe: one cross fitting with side outlet and four ells. The arms that screw into the four-way fitting are each 7 in. long in this case. Their length of course will have to be in proportion to the diameter of the garbage pail used. On the end of each arm is screwed an elbow, which in turn carries a vertical pipe 10 in. long. Finally, a single pipe 56 in. long is turned into the underside of the four-way coupling and is driven solidly into the ground.

If desired, the upright can be set in concrete. The support is then complete save for a coat of paint.—D. V. H.

A convenient stand for a garbage pail

This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 8.

WINTER FEEDER HOLDS SUET FOR BIRDS

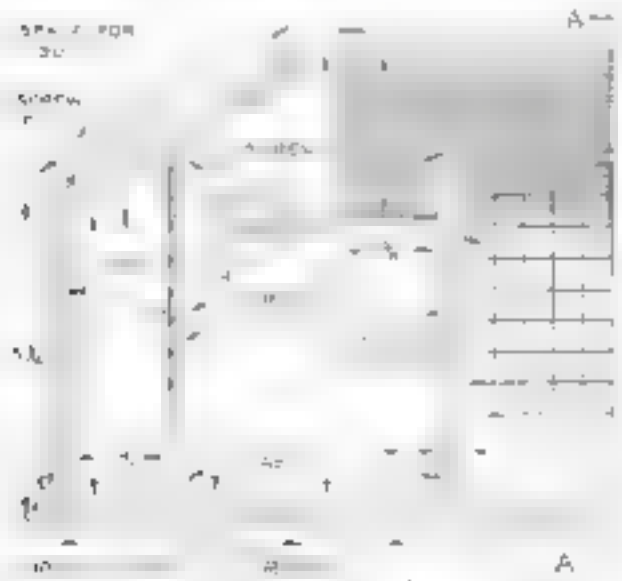
Nothing encourages the birds to visit one's yard in winter like a well-stocked feeder

WINTER feeders for our small feathered friends can be quickly and easily made from scrap or packing-case lumber. The particular feeder illustrated is designed to hold bread or suet and is so constructed that cats or large birds cannot carry all the food away.

The feeder can be made from any suitable stock, ½-in. boards being used in the design shown. The top, sides, and back are covered with pine, hickory or oak bark to improve their appearance. The back, which is held in place by the bevel at the top and two hooks and eyes at the bottom, is removable to allow the suet or stale bread to be placed behind the wire grill. The grill itself is a 4½ by 6 in. piece of wire netting having openings of either ⅜ or ½ in.; it is held with two ¼ by ½ in. strips screwed to the sides.

The entire feeder should be stained a dark brown inside and out before the bark is fastened on with brads.

Place the feeder on a pole or in a tree so that its front face is away from the north. It can be hung by means of a large screw eye in the center of the top about ½ in. from the back edge.—G. H. W.



SECTION THROUGH A—A ½ OF FRONT

The left half of the feeder as seen from the front, and a cross section through the center

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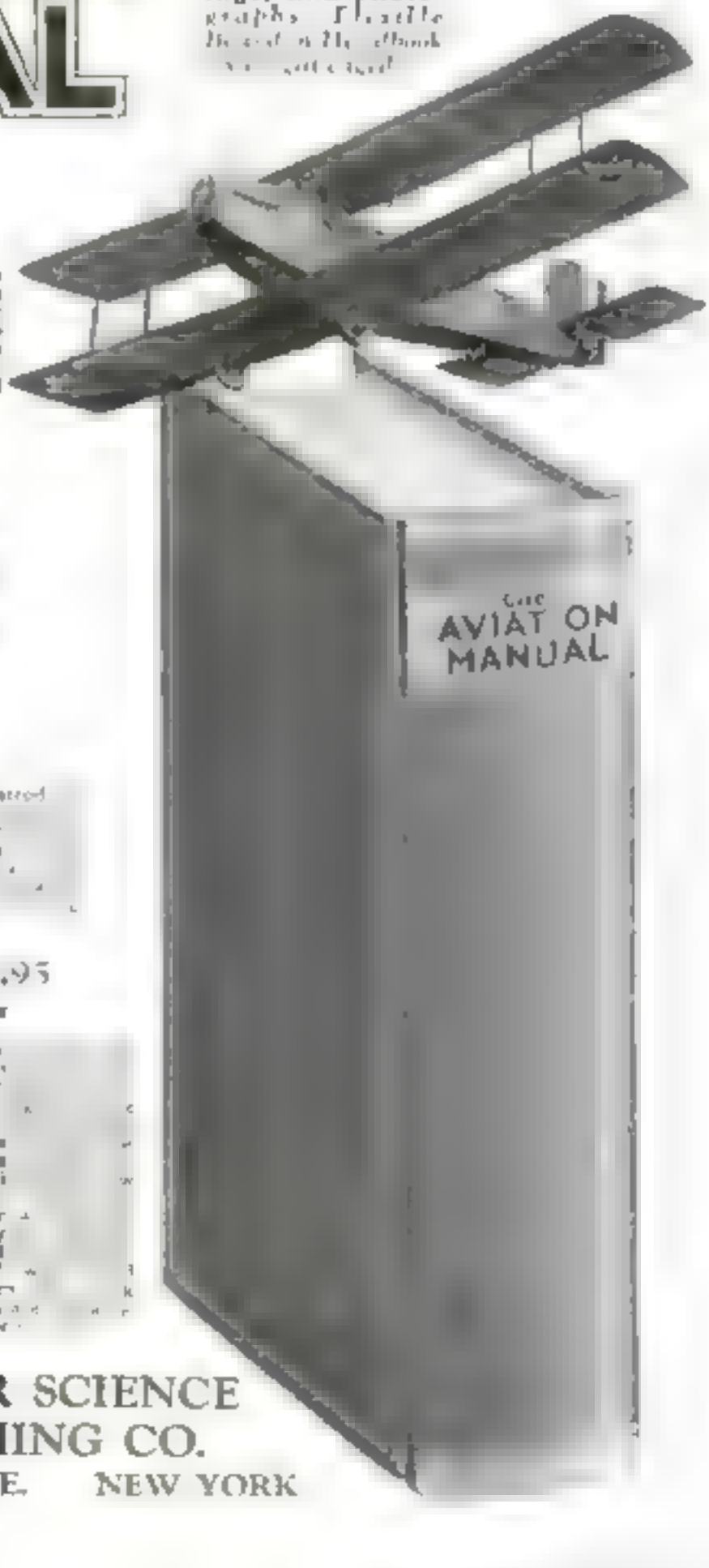

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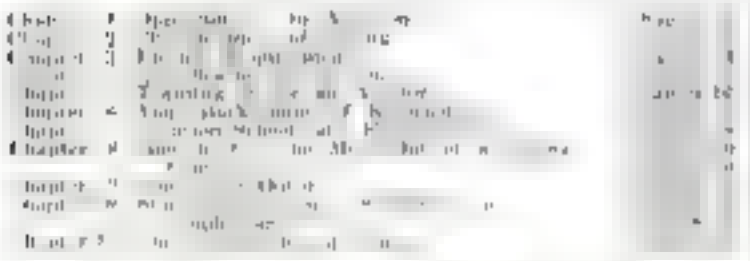

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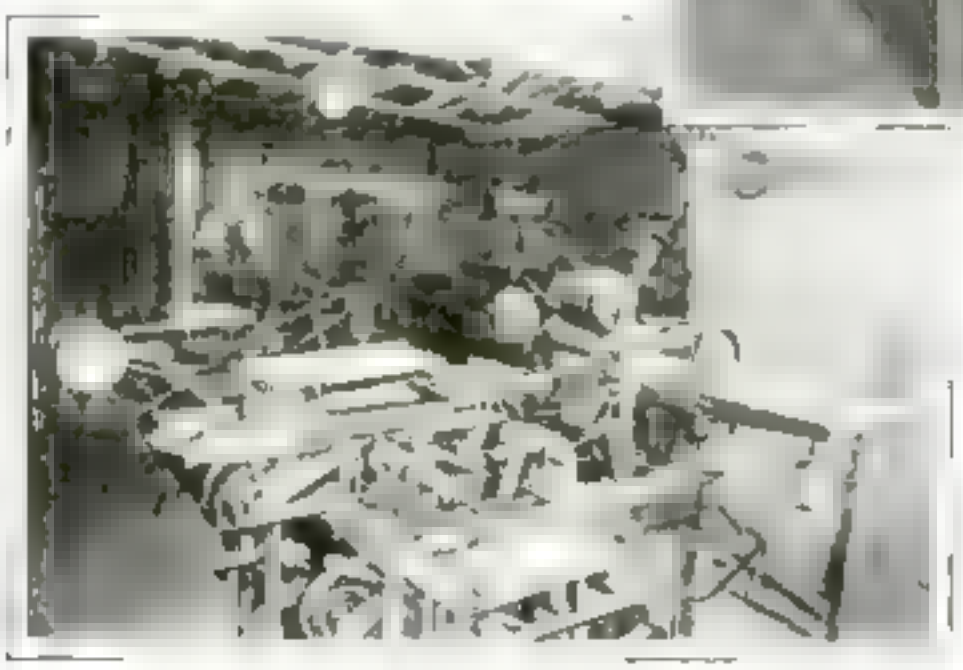
Who's Who among Shop Owners



THIS [illegible] with his home w[illegible] men are a w[illegible] visit [illegible] whenever t[illegible] shop which has been appearing in POPULAR SCIENCE MONTHLY.

In the center of the large basement

homemade steel framework upon which are mounted the principal woodworking machines. These are all separate units driven from a line shaft that runs underneath, near the floor. The machines include rip and cut-off saws, a universal saw table for cutting compound miters and other fine work, a 4-in. jointer, a lathe with 10-in. swing and 3-ft. bed, an 18-in. band saw, a jig saw, a single spindle shaper, a hollow chisel mortiser and boring machine, a 2-in. tenoning machine, a rod and dowel machine, an 8-in. surface sander, a 4-in. belt sander and two sanding disks.

In addition, Mr. Keyser has an engine lathe, drill press, and several grinders.

His woodworking bench, which like much of the equipment is his own handwork, is a model of convenience. It has three vises, one of which is of the rarely seen universal tilting type.

In what little leisure time his work as a mill foreman for a railroad company leaves him, Mr. Keyser has constructed ship models, a stagecoach model, toy airplanes, and many pieces of furniture, besides making repairs of almost every imaginable variety.—W. T. SCOTT.

Secrets of the Fortune-Telling Racket

Condensed from P. S.

They demand the involved, pseudo-astronomical phraseology of the astrologer and the pseudo-mathematics and fantastic palaver about "name vibrations" of the numerologist. How dependable astrological and numerological forecasts are, may be judged from these facts:

A pamphlet, giving horoscopes for the various months, still used by hundreds of diviners, was written as a joke by a popular stage magician when a boy. It has sold 100,000 copies. The "lecture" delivered by a well-known fortune teller at a New Jersey coast resort was written for him by a newspaper man of my acquaintance, as was the book of horoscopes the soothsayer sells for $1 a copy. This same reporter is the author of a widely used "text book" of numerology.

FORTUNE tellers' methods vary, but their technique is always the same. It consists of getting by hook or by crook, all the information they can about the customer, presenting it in the most impressive way, and convincing the victim, by means of all sorts of mummery and tricks, of the truth of their assertions.

How the average soothsayer gathers the necessary data concerning his client or "sucker," as he is called in the lingo of the trade, can best be illustrated by a couple of examples. Here is a recent case that came to the attention of Mulholland:

A man who always had been skeptical about fortune telling, was told by a friend so much about the powers of a certain palmist that he decided to give him a trial. He was thinking of making a business change, and had no other question in mind. Phoning for an appointment, he was told the "professor" would be able to receive him in half an hour.

When he entered the "studio" he was greeted by the palmist who, without a single question, began telling him about his wife, son, and daughter. He mentioned their names, talked of the children's school work and other personal matters. Peering into the customer's hand, the "professor" told him he was a college man, stated correctly the business in which he was engaged, and the name of the firm which employed him, and advised him not to make any change in business that would take him away from the city.

Thoroughly impressed, the man came away convinced of the seer's powers. As the palmist advised, he turned down a splendid offer from a firm in another part of the country.

What happened was this: When the client phoned for an appointment, he gave his name. The fortune teller's assistant immediately consulted the telephone directories. The current book showed he was living in a private house in a new neighborhood, an older one gave his address at an apartment building.

The assistant phoned the man's home and, claiming to be a photographer, asked the man's wife if he might take pictures of the children. Making an offer of a number of free photographs, he obtained the children's names and their ages. On the pretext of desiring to obtain the father's permission to photograph the children, the assistant was given his business telephone number and a call there elicited information as to the position he had and so on. A city directory furnished the name of the school for the neighborhood and the name of the principal.

This was all the information the palmist could get in half and hour, but it was enough. Naturally, he could not know the particular question in the man's mind, but all fortune tellers know from experience that their victims consult them on only two subjects—love and money. Proceeding on the theory that the question was about a loved one, he first spoke of the family. Then he tackled a hypothetical business problem. Evidently, the client had just bought a home and it was unlikely that he would wish to move away from town. Hence the advice against a change in business that would take him to another city.

Now, suppose that the customer does not phone for an appointment but walks into the diviner's establishment from the street. In that case, Mulholland told me, the client is ushered into the seer's presence as soon as possible. Immediately, the faker's particular brand of mummery, be it cards, crystal, palm reading or astrology, is brought into play.

While the fortune teller delivers a long, vague harangue, his assistant outside, who took the client's name upon his arrival, gets busy with the telephone. As the time is shorter less information is gathered in such cases, but it usually serves.

How is this information conveyed to the soothsayer? Here is where what may be called the physical tricks of the trade come in, and some of these Mulholland demonstrated to me. Some of the more elaborate establishments have a picture on one of the walls that is so constructed as to act as a secret panel. While the glass and frame remain stationary on the wall, the back of the contraption and the picture itself can be dropped by the man in the anteroom who thus is able to insert a card containing the information.

NATURALLY, the victim is placed with his back to the picture and the fortune teller simply reads his name, occupation and such other data as the assistant was able to gather, above the customer's head. The reason for using a picture is that an ordinary movable panel might be detected by a keen observer, classed by the trade as "an annoying sucker."

In the absence of a panel, the seer seats himself with his back to some hangings, through which a small card bearing the information is easily passed to him in the semi-darkness that pervades nearly all of the charlatans' inner sanctums. The card the fortune teller conceals in his hand while gazing into his crystal, or places at the bottom of the pack in case cards are his penalty.

Now let us assume that the client is not listed in the telephone book nor in any professional or other directory. In that event, the fortune teller has to rely on his wits, which usually are pretty sharp. The following is an actual case of this kind which Mulholland related to me:

A pretty young widow visited a soothsayer to get advice on the wisdom of remarrying. Her costume consisted of a dark dress, a hat of last season, and new shoes. She wore a wedding ring and a string of beads, but no other jewelry. As it was summer, she wore no coat, and she did not carry a pocketbook. Without her having said one word, the diviner told her fortune simply from her appearance.

He told the woman she was not used to work and that she ought to accept the offer of marriage she was considering. This, he said, would be exactly what her late husband would have wanted her to do. Dumfounded by the man's powers of divination, the woman praised him to the skies, and shortly afterward married a worthless individual.

These were the fortune teller's observations and deductions. The wedding ring showed the woman had been married. It was of a better kind than the dress she wore indicated she could now afford. The gown looked like one worn for second mourning. Thus, she probably was a widow in reduced circumstances.

The new shoes were of a brand advertised to help foot trouble; hence it was likely that she was doing work involving a good deal of standing, to which she was not accustomed.

The string of beads was new and rather expensive, and the seer reasoned it must be a gift from some man who was in love with her. He guessed that she wanted to marry again, but felt she should remain faithful to her husband's memory. So he told her what he believed she would be glad to hear.

All of us carry some marks of identification. Even if you do not wear a Rotary Club or service button, a lodge or fraternity pin, your rings, your watch and chain, the cut of your clothes and hair, your speech and mannerisms will tell the soothsayer a number of things that he will repeat to you, translated into the flowery lingo of his profession, at a price.

Many fortune tellers use simple conjuring tricks to impress the "suckers" with their occult powers. A great favorite is the fire bowl. The client writes his question on a piece of paper, which he folds twice and drops into a brass bowl. Muttering a meaningless incantation, the diviner holds the paper and peers into the flames. When the note has been burned to ashes, he reaches for his crystal and delivers a long, general "reading." This finished, he gives the answer, which he is supposed to read in the crystal.

With the aid of a small ash tray, Mulholland showed me how this is done. I wrote a question and dropped the folded paper into the brass dish. It was burned and the magician gave me an answer which showed that he must know what I had written. Then he lifted the ash tray. It had a secret compartment, into which he had slipped my note, leaving a blank piece of paper. This blank had been concealed in the "gimmick" before the beginning of the "seance." The two pieces of paper were switched by a simple sleight-of-hand trick.

To make this stunt even more impressive the soothsayers sometimes resort to slate writing. Again, a question is written on a piece of paper and "burned" in a bowl with a "gimmick." But now the bowl is placed on a shelf in front of a secret panel in the wall, through which a confederate in the next room can remove the paper bearing the question.

MEANWHILE, the fortune teller produces a slate and a small piece of chalk. He tells the customer to hold the slate on his knee under the table where the seer can write the answer. After a minute or two, the faker takes the slate from the "sucker's" hands under the table, and then pretends to place the slate, which now is supposed to contain an answer, on top of the table. But it is not the same slate. Another has quickly been substituted. On this, the assistant, who read the question, has scribbled an answer. The second slate is handed to the soothsayer through dark hangings in front of which he is seated.

A variation of the fire-bowl trick is a "gimmick" box in which the client is told to lock his question. The customer holds the key, while the paper drops into the hand of the soothsayer through a little trap.

Selling knowledge that they do not possess, fortune tellers swindle the public out of millions. But even this is not the worst phase of their racket. The real danger lies in the fact that, more often than not, the advice they give is unwise and destructive.

FLYING WITH PIONEERS

(Continued from page 42)

toric flight down the Hudson when he won the $10,000 prize offered by the New York *World*.

One of the high points of American aviation was Curtiss' victory over Louis Bleriot in the first Gordon Bennett Cup race at Rheims, France, in 1909. In his homemade machine he averaged forty-three miles an hour and carried off the cup. In twenty years that record has jumped to more than 350 miles an hour, and a dozen modern racing ships can exceed 200. Bleriot was the hero of France when he met Curtiss above the sandy plains of Rheims. The month before he had flown the English Channel—a feat that stirred the world in 1909 almost as much as Lindbergh's hop to Paris did in '27.

I MET him one foggy morning at Calais on the French side of the channel when he was tuning up the spluttering little three-cylinder Anzani engine for the attempt. That afternoon, he took a train back to Paris to get a rudder wheel to replace the skid at the rear of the fuselage. This wheel enabled him to gain momentum quicker on the take-off.

A day or so before he took off, he was badly burned by a gasoline explosion and when he hobbled to the cockpit on crutches and prepared to head for the white chalk cliffs of Dover, he had spent practically his last cent. When I saw him circle upward in his graceful birdlike machine, I got the airplane fever for the first time. The following year I bought a Bleriot of my own and taught myself to fly.

Another pilot was also at Calais with Bleriot fighting for Lord Northcliffe's $50,000 prize for the first plane across. This was Hubert Latham. His beautiful Antoinette monoplane looked like a fifty-foot dragon fly of wood and canvas. Twice he started from the French side. Each time his motor faltered and he dropped into the water of the Channel. I was on board the French destroyer that rescued him the second time when he was again down less than half a mile from the Dover Coast. We found him perched on one of the wings calmly smoking a cigarette.

THE following year Latham took me around the course at Belmont Park, N. Y., in a roaring Antoinette "wind fighter." The long slender wings of his racer shaved the pylons on every turn. Latham was one of the most fearless flyers of that reckless age of aviation. At Blackpool, England, he made a flight that specialists never forgot, battling a howling gale that carried him backward across the field time after time.

One of the first to follow Bleriot's cross-channel trail was a former Chicago baker boy and soldier of fortune, John Moisant. As soon as Bleriot had taught him to fly, he loaded his pet kitten "Paree" into his machine and set out from Paris to London. Because of bad weather and accidents, it took Moisant and his kitten nearly a month to reach the British capital, but when they did, they were the first to cover the route now followed by the huge planes that ply like ferryboats between the two capitals.

The years 1910, 1911, and 1912 were the Bonanza years of aviation. In fast machines, the pilots rode to quick fame, quick riches, and, too often, to quick death. They were a colorful lot—little Audemars, an eighty-seven pound cricket of a man who drove a tiny Demoiselle monoplane sitting on a narrow strip of canvas for a pilot's seat; Charles K. Hamilton, dare-devil Curtiss flyer who was (Continued on page 132)

FLYING WITH THE PIONEERS

Continued from Page 131

consumptive and wanted to die with his boots on, Harry N. Atwood, who flew from St. Louis to Chicago with American flags streaming from the struts of his Wright machine, Earle T. Ovington, the American Blériot flyer and the first U. S. air mail pilot, who carried a "lucky dog" wired to his fuselage when he left the ground; Micky McGuire, "The Wild Irish Rose of the Sky," who always went aloft wearing a flower in his buttonhole.

Another of these picturesque chance-takers, who advanced aviation at the risk of their lives by showing designers the weak points in their early planes, was the little Frenchman, Louis Paulham. When the Wrights first flew, Paulham was a bareback rider in a circus. For six months he worked in a French airplane factory for next to nothing to learn all about planes. Then, in 1910, he cleaned up $100,000 in prizes with his Farman biplane. He also piloted Blériot monoplanes with equal ease.

AT THE Los Angeles meet of 1910, the Wrights, who were seeking to collect royalties from other makers of planes, caused the warping wires of his Blériot to be sealed so he could not leave the ground. Paulham's contract called for at least one flight in the monoplane. On the last day of the meet, he started the motor, jumped into the cockpit, and hopped off despite the fact that the warping wires were paralyzed so he had no lateral control of the machine. He circled the field, skidding around the turns without banking, and landed safely after a flight of more than a mile. It was a thrilling example of expert airmanship.

I was with Paulham when he defeated Claude Grahame-White, the English pilot, in the race from London to Manchester. His Farman biplane, with a whirling Gnome motor, was the first airplane in which I ever rode. Farmans are still manufactured in France and many of the huge air liners used on the French commercial lines are produced in this pioneer factory. On one trip to Europe I rode one as a passenger on an established airway.

Henry Farman, himself, in 1911, took me up in one of his early pushers in which we pushed on a ladderlike framework stuck out in front of the lower wing. Another early French pioneer was Robert Esnault-Pelterie. I flew with him on a cross-country hop in his curious "R. E. P." monoplane in 1913. It was the first machine in the world to be operated by means of a "joy stick," the method now universally used.

ONE of the best of the early monoplane pilots was Roland Garros. He held a long string of world records before the war. Like Hamilton and Latham, he had weak lungs and knew his days were numbered. He died in 1914 in one of the most dramatic events of the World War.

A huge Zeppelin was heading over the lines on one of the first bombing raids on Paris. Garros was on patrol duty. He dove on the monster, firing with his machine gun. Seeing he could not stop it this way, he climbed high above it and, roaring down out of the sky, crashed into the top of the huge gasbag. His red-hot motor ignited the hydrogen, and riding the flaming Zeppelin, Garros went down with his victim.

Zeppelins were familiar craft to me before the war. I knew white-haired, kindly Count Zeppelin well and made a number of flights with him in his rigid airships. Once he invited me to attend an aerial Christmas party high in the air above Berlin. Few Americans know that Zeppelin's first balloon ascension was made near St. Paul, Minnesota, during the Civil War. I also met Hugo Eckener, famous skipper of the *Graf Zeppelin*, a number of times while on these visits to the Zeppelin works at Friedrichshafen, Germany.

The Chicago Aviation Meet of 1911, at which I was Field Captain, was probably the most spectacular flying competition ever held. Here Lincoln Beachey, the greatest stunt flyer of them all, began his breath-taking game of tag with death. Once I saw him skim along a Lake Shore freight train so close his landing wheels seemed rolling on the car tops.

ONCE, he told us he was going to break the world's altitude record. Instead of going about it in the usual way, he filled his tanks until they ran over, took off, and kept climbing until every drop of fuel was gone. Then he spiraled down from a height of 11,642 feet, landing after dark on the lake front field with a new record.

While Beachey was a stunt flyer, pure and simple, one effect of his flying was better airplanes. Designers, seeking to produce planes strong enough to withstand these strains, produced sounder and safer machines.

The first time I met Beachey was in 1910 when he was a mechanic for "Daredevil Tom" Baldwin in California. Later, when he was piloting a biplane of his own, we raced our "rubber cows" at large cities in the Middle West. One whole winter, Beachey and I flew at Mexico City, advertising a new Mexican cigarette. We made thirty flights with a motored gas bag, lived like kings, and returned to the United States with more than $10,000 apiece in our pockets.

Nearly a million people jammed the San Francisco streets near the Panama Pacific Exposition grounds in 1915 when he took off on his last flight. They saw his little Taube monoplane loop and dive, then collapse and rocket in a sheer 3,000-foot plunge into the waters of San Francisco Bay.

BEACHEY was a natural flyer, just as Lindbergh is. Curiously enough I also knew Lindbergh long before he was famous, just as I had known Beachey. After the war I helped organize a flying school and factory at Lincoln, Nebraska. It was at this school that "Slim" made his first flight. He started in greasing Hisso engines at $15 a week. He was hard-working and quiet. The first time we paid much attention to him was when three of us found skunk tails curled up in our dress suit pockets when we started for a banquet. His career in flying almost came to an end right then and there.

The climax of my aviation experiences came that spring morning in 1927 when I looked down from a New York office building on Lindbergh's triumphal return from France. I could hardly realize that I had actually had a grandstand seat at the very beginning of the airplane. It seems like last week that I had met Chanute, the Wrights, Montgomery, and Curtiss. It seems but a few hours ago that I was flying pioneer "rubber cows", but a moment since I knew the early aviators. In forty short years, miracles have happened in the air. But these miracles, I am firmly convinced, will seem commonplace beside the greater aerial marvels another forty years will bring.

Next month Captain Wild will relate other adventures and experiences of the thrilling days when flying was young and daring men carelessly risked their lives to give us the modern airplane.

TRANSMISSION TRICKS

(Continued from page 84)

is noisy and has a lot of lost motion, so the really good one-way clutches have a number of balls or rollers so fitted that they jam and lock the shafts when the force is in one direction and start to slide when the force is applied from the other end."

"That seems clear enough," Donaldson observed. "But if the idea is so old why hasn't some one used it before?"

"How should I know?" Gus countered. "There's hundreds of ideas that might be used in a car. Only time will tell which ones will prove worth while. Free-wheeling certainly should save gas and wear on the motor in average driving, but sure as shooting it's going to wear out the brake linings faster. You'd get the most benefit out of free-wheeling in rolling country same as you would out of a coaster brake on a bicycle. On steady level going it wouldn't mean anything. The cars that have it are fixed so you can lock the free-wheel gadget and not use it while the going isn't the kind where free-wheeling is worth while—coming down a mountain, for instance, when you want to use the drag of the motor to save the brakes."

"Now I see why my idea of free-wheeling was wide of the mark," Donaldson nodded. "Coasting in neutral isn't the same, is it?"

"NOT by a long shot," said Gus emphatically. "Besides, coasting in neutral is against the law in some states because too many people get into trouble that way. They couldn't get back into gear and get rattled same as you did. You forgot that gears have to be turning over at somewhere near the same speed before you can mesh 'em. Of course if you had a synchro-mesh transmission you couldn't have had that trouble."

"How would that have helped?"

"Simply because the synchro-mesh transmission," Gus explained, "has an extra little clutch for each speed that goes into action when you move the gear lever. The clutch takes hold just before the gears go together and forces 'em to run at the same speed. Clashing gears isn't possible because clashing means gear teeth going past each other and when two gears are turning at the same speed their teeth can't pass each other."

"I hope Mrs. Donaldson doesn't become familiar with the fact that gears should not be clashed," the professor observed, "at least until I can shift with less noise, otherwise I should be compelled, in self-defense, to purchase a car with that feature. Is a transmission with a silent second speed constructed in the same manner?"

"No," said Gus, "that's something else again. Transmissions with silent second speeds really are offshoots of another kind of development. Maybe you remember there was a lot of talk about four-speed transmissions a couple of years ago? The silent second speed transmission really is a relative of the fancy four-speed outfit."

"Four-speed transmissions were made just like the regular three-speed outfit only with an extra gear for economical level driving. The extra fourth speed had internal gears which are not so noisy because the teeth kind of slide together instead of bumping. The idea worked grand. Fourth speed was almost as quiet as third. Then along came some engineers and said: 'Why not use those nice, quiet internal fourth-speed gears for second speed in a regular three-speed job? Then people wouldn't mind using second speed and we could gear up the rear axle a bit to get more economy.'"

"Hm," said Professor Donaldson. "I imagine what I require is a transmission that includes them all."

Gus grinned. "That's an order I'm afraid no car manufacturer can fill—just yet."

DIVER FLIES—FLYER DIVES

(Continued from page 55.)

spot marks a tiny blood vessel that has burst under the pressure of the bubbles. The pain is terrible. Temporary paralysis often results when the bubbles form in the spinal column. To avoid the bends, a diver pauses at different depths in coming up to "decompress" or allow the gases to be thrown off normally by the lungs."

Do you have to be as careful going down as coming up?"

No, you can go down faster than you can come up. We usually descend at the rate of about a foot a second. A diver regulates his descent by his ears. When they begin to pain from the excess pressure on the outside of the drum he slows down. I chew gum and swallow frequently to let the air get inside the drum and equalize the pressure on my eardrums."

WE had climbed aboard the diving boat with two great tanks of compressed air at the stern, and were heading down the Thames toward Long Island Sound.

"We compress ordinary air," Loughman explained, "If we sent down oxygen such as aviators use at high altitudes, it would be too hard on the diver's lungs. Under great pressures it would burn them up."

Besides Loughman and the commander of the diving boat, there were half a dozen "bears" on board. A "bear" is a dresser who helps a diver get into his suit. It would be impossible for him to get on the heavy and awkward suit by himself. When we finally anchored in a sheltered cove, Loughman brought out a suit of heavy blue knit woolen underwear.

"The only things you wear inside a diving suit," he said, "are these divers' pajamas."

By the time I had on the pajamas, the diving suit was laid out for me. It was in one piece and looked big enough for a giant. While the "bears" pulled it over my head, I examined the material. It was rubberized fabric, something like raincoat cloth and about a sixteenth of an inch thick. That seemed pretty thin to trust my life to. It was my turn to remember the newspaper headlines about diving accidents.

Have you ever heard of a suit springing a leak underwater?" I asked Loughman.

"Oh, sure," he said. I swallowed hard and must have looked sick.

"What happens?"

"Nothing much. I once was down in a suit that leaked so badly it filled with water up to my waist. You see, the air circulates all through the suit and if the water enters it runs down to your feet and, as it rises, it compresses the air up into the helmet. It never rises above your chin so you can keep on breathing."

One of the dressers was smearing my hands and wrists with suit soap from a tin pail. This allows the tight rubber wrists of the diving suit to slip on. My hands were left bare, the wrists of the sleeves fitting snugly and keeping out the water. As an extra precaution, wide rubber bands were snapped on over the wrists at the last moment.

While two of the "bears" laced up the backs of the legs of the suit, another brought huge metal shoes, that had ropes for laces and worked my feet into them. Loughman explained:

"Those two shoes weigh as much as a fifty-pound sack of flour. A diver who tips the scales at 150 pounds stripped will weigh about 465 pounds with his suit on."

"How can he move around in the water?"

"When he gets under, the buoyancy of the air inside the suit neutralizes the weight so he can walk around without great difficulty. In fact, if you let too much air get in your suit, you will pop up suddenly to the surface like a cork."

While we were talking, a thirty-pound breastplate of bronze had been slipped over my head and bolted to the collar of the suit. A little brown cloth skullcap, with earphones attached, was strapped to my head. Those on the surface can talk with a diver by telephone as well as communicate with him through jerking the lifeline.

"If you will come over to the ladder now, we will put on your belt and helmet."

I stood up and tried to walk. They all laughed. Moving with those twenty five-pound shoes was like trying to run in a night mare. When I arrived at the gunwale I was panting. I was told to lie on my side. Two "bears" grabbed my feet and swung my legs over the gunwale onto a steel ladder that descended into the water. I felt as helpless as a baby. They doubled me over the gunwale as though they were going to paddle me and strapped about my waist a 100-pound belt of lead. When I straightened up, I felt as though I had a steel railroad rail on each shoulder. I was all tired out and I hadn't started yet.

"Anybody can have this job that wants it, right now," I told Loughman. He grinned.

"You don't know half of it yet," he said, and brought over the great bronze helmet that weighed seventy pounds more. With two men helping him, he slipped it in place. When that hollow metal ball settled down over my head, I knew how Loughman had felt when he placed his life in my hands on his first airplane ride. I was used to having a whole sky full of air to breathe. That helmet seemed like a tiny room holding just enough air for a single breath. If anything happened to that airline when I was on the bottom. . . . I decided not to think of that and concentrated on the precautions.

The grated glass window in front of the helmet was left open until the last minute. Loughman turned a small valve wheel near my left hand on the suit. With a loud hiss the compressed air entered the helmet just above my left temple. Loughman adjusted the valve. A diver is trained to tell when the right amount of air is coming in by the sound.

See that flat plunger to the right of your chin?" I noticed. "When so much air gets in your suit that it balloons out, press against that plunger with your chin. It operates the safety valve and lets out some of the air."

I COULD see one of the "bears" uncoiling the inch-thick air hose with the rope lifeline taped to it. Loughman was giving final instructions.

"When you reach bottom, jerk your lifeline once. When you want more slack to walk around, jerk it twice. When you want to come up, jerk it three times. Answer all signals. If we give one jerk up here, it means, Are you OK? You give one jerk in answer. That means, OK. If you don't answer, we will pull you up to see what is the matter."

"How deep is the water here?" I asked. "I can't see bottom."

"It isn't very deep, only twenty feet or so."

"*Only* twenty feet!" I had arrived at the place where I wanted to kick myself, now. But with twenty-five-pound shoes on, that was impossible. So I said: "All right, let's go."

"When everything is secure," Loughman said, "I'll tap the

(Continued on page 135.)

DIVER FLIES—FLYER DIVES

(Continued from page 134)

helmet twice. That means: Go down."

He slammed shut the little glass window of the helmet and screwed home the bolt. I took a deep breath. The air had a rubbery smell. There was a hollow clang, twice repeated, just above my head—the signal to descend. I moved one heavy foot down a rung, then the next. Suddenly my legs grew cool and they seemed relieved of the weight of the shoes. They were underwater and the buoyancy of the air-inlet suit was beginning to have its effect

I KEPT on until the water closed over my head. I waited a minute, ready to duck up if anything was wrong. Then I let go the ladder and slid slowly down the lifeline. I was entering a strange silent world of greenish water. Instead of the deafening roar of an airplane motor, there was only the monotonous hiss of air entering the helmet. My ears began to hurt. I stopped and swallowed hard, then went on. My feet sank into the mud. I jerked the lifeline once. There came an answering jerk. I pulled it twice. I was going to try to walk around. Then something strange happened. I seemed bewitched. I couldn't make my feet behave.

"You are walking backward." A small voice sounded in my ear as though someone were shouting through a pipe a great distance away. It was Loughman talking over the telephone. "Try crawling. That is easier."

I tried to crawl. I couldn't stay on the bottom. Too much air in the suit. I jerked my head around and pressed the safety valve with my chin. The suit suddenly pressed against my legs as the excess air escaped. Now I was crawling along the bottom, the shoe openings of the helmet only a foot or two from the floor of the cove. I passed over a waterlogged timber, worn smooth by the restless movements of the tide, over a stone or two and numerous shells. Then, directly in my path, I saw two starfish, one six inches or more across, the other smaller. I reached for them twice before I could gage my distance in the dim wavering light. Just as I grasped them, the lifeline jerked once. Loughman wanted to know if I was all right. I gave a reassuring pull.

"You have been down five minutes," his voice reached my ear. "Want to come up?"

I GAVE three jerks to the lifeline and clinging to my sea-bottom trophies, was hauled steadily upward. When I reached the top of the ladder and handed them over to Loughman, I was nearly exhausted. That five minutes underwater tired me more than five hours in an airplane would have done.

On the way from the flying field to the Submarine Base, Loughman had said: "I believe I like flying better than diving."

"SEVEN LEAGUE BOOTS" MAY HAVE BEEN STILTS

THAT there may be some basis in fact for the legends of "seven-league boots," was suggested recently to the English Folk Lore Society. It was pointed out that long-ago inhabitants of the fenlands, marshy districts in the south of England, may have gone about on stilts, acquiring great proficiency in their use. By this means they would have been able to cover the ground at great speed to the consternation of their neighbors on drier ground.

Supporting this theory, it was pointed out that French shepherds in Gascony go about on stilts very commonly, soon becoming expert in their use in early youth.

DID HEALTH RAYS CREATE LIFE?

(Continued from page 21

As for sun-lamps, they also voiced the judgment of private medical authority when they commended the approved types but cautioned laymen against their use in cases of disease without the advice of a competent physician. The large amount of ultraviolet rays of short wave-length some lamps emit they declared, may cause serious injury to the eyes unless goggles are used. They also may prove harmful to the skin, result in grave symptoms in persons with low blood pressure and in unfavorable effects in patients in the early stages of tuberculosis. Exposure to ultraviolet radiation may cause restlessness and, in overdoses, anemia. It also has been responsible for severe burns.

MEDICAL research is a kind of glorified detective work. It consists of following up clues, relating them to one another, and finally fitting them together to form a set of complete conclusions. This sequence of discoveries led to the solution of The Great Rickets Mystery.

First: In 1918, Dr. E. Mellanby, an American research worker, called attention to the presence of an antirachitic factor, or vitamin, in the prevention of rickets. The question he posed was: Is this vitamin the same as Vitamin A, the growth-producing, blindness-preventing vitamin, or a different one?

Second: Dr. K. Hubtschinsky, an Austrian specialist, in 1919 first proved that ultraviolet rays from a mercury vapor lamp would cure rickets.

Third: In [illegible] Drs. A. F. Hess and L. J. Unger of New York City demonstrated the curative effect of sunshine in cases of rickets.

Fourth: Four other Americans, Drs. E. V. McCollum, M. Simmonds, J. E. Becker and P. G. Shipley, proved conclusively in 19[illegible] that there is a distinct rickets-preventing vitamin. It became known as Vitamin D.

These four steps brought up another question. If ultraviolet rays and Vitamin D in each a sure cure for rickets, might there not be some connection between the two?

Three groups of investigators, working independently in this country and abroad proved that there is such a connection. In England Drs. O. Rosenheim and T. A. Webster; in America Drs. A. F. Hess, M. Weinstock and F. D. Heman, and Drs. H. Steenbock and A. Black, demonstrated that cholesterol, a substance found in certain foods, could be made antirachitic by exposure to ultraviolet rays. In other words, they found that the rays changed the cholesterol into Vitamin D.

LATER, these men, aided by Professor Adolph Windaus, of Germany, discovered that it really was not the cholesterol itself but an impurity present in it in minute quantities, called ergosterol, which was "activated" by the rays. For his part in this discovery, Dr. Windaus was awarded the 1928 Nobel Prize in chemistry.

Because we take most medicines and tonics internally, it is easy to understand how we can absorb Vitamin D by eating foods impregnated with it. But how can external baths of ultraviolet rays have a similar effect? The answer is that we have ergosterol in our skin. By bathing in ultraviolet rays this ergosterol is exposed to their action. The Vitamin D thus produced is then absorbed in the blood.

It was Dr. Harry Steenbock, of the University of Wisconsin, who worked out and patented a process for exposing certain foods to ultraviolet radiation, thereby enriching them with Vitamin D. Then, refusing to enrich himself, he turned over his patent to the Wisconsin Alumni Research Foundation, which now controls it.

A few manufacturers, licensed by the Foundation, have placed on the market rolled oats, dry cereal, dried milk and crackers treated with the Steenbock process. More will come as soon as methods are perfected for controlling the amount of ultraviolet radiation the foods should contain.

In an attempt to increase the rickets-preventing properties of cow's milk, a group of University of Wisconsin investigators under Dr. Steenbock not long ago fed the processed cod liver oil to cows, but without success. Yeast exposed to ultraviolet rays proved a better antirachitic cattle feed, he reported. Exposure of the cows themselves to the ultraviolet rays of the sun has no effect on the Vitamin D content of their milk, the investigators found.

HENS, however, are said to be more responsive to ultraviolet irradiation and to lay more eggs when exposed to the beneficent rays. This may be due to the fact that feathers have a fairly high transmission of ultraviolet light, a discovery made by Dr. Coblentz, of the U. S. Bureau of Standards.

Since ultraviolet rays of certain strength are of proved value in the treatment of rickets, scientists speak of their degree of potency in terms of antirachitic quality. In other words, ultraviolet rays powerful enough to be antirachitic are a unit, as a standard. Rays not powerful enough to prevent rickets are [illegible] reports [illegible] of value.

The difficulty of knowing how much ultraviolet you are actually getting from the sun is equaled by that of gaging an accurate dose from electric lamps. Most doctors cannot [illegible] for they have no means of checking their lamps except [illegible] sending them to a private or [illegible] laboratory. Fame and fortune await the inventor who will devise a simple and absolute method of checking the strength of ultraviolet rays, so that their dosages may be prescribed with as much precision as that followed in the prescription of drugs.

Because of their lack of penetration, it is doubtful that ultraviolet rays have any ability to relieve pain. When sun lamps or strong direct sunlight are used for this purpose, it is not the ultraviolet, but the deeply penetrating infra-red, or heat rays, which produce the desired effect. They deaden the nerves much in the same way as a local anesthetic. A carbon arc lamp gives off ten times more infra-red rays than ultraviolet.

ULTRAVIOLET rays have been put to other uses besides preventing and curing disease. For example, it has proved a valuable aid in detecting adulteration in fabrics and frauds of several other kinds. Substances exposed to ultraviolet rays, in a dark room, fluoresce or glow with a colored radiance all their own. So far as is known, no two substances fluoresce alike. A tiny trace of a substance, even one part mixed with 5,000,000 parts of something else, still will glow with its own individual color.

Suppose you are trying to tell the difference between two bolts of silk of identical hue and quality. They look and feel exactly alike. But their makers have impregnated each with minute quantities of two substances that fluoresce differently. Focus a beam of ultraviolet light, in a dark room, first on one bolt, then on the other. The first will glow, say, with a bluish sheen, marking it as the product of Manufacturer A. The second *(Continued on page 137)*

DID HEALTH RAYS CREATE LIFE?

(Continued from page 136)

glows yellow and is, therefore, the product of Manufacturer B.

Not only fabrics, but merchandise of all kinds, liquid or solid, can be secretly trade-marked in this way. Money for use as a "plant" in extortion or bribe cases can thus be marked. Forgeries and bogus documents can be detected. Communications written in invisible ink can be read easily, and ancient manuscripts have been deciphered in this way. Traces of denaturant in booze made from re-distilled alcohol can be detected under ultraviolet rays, even when chemical analysis fails.

Fluorescence also is helpful in medical diagnosis. Certain skin affections, for instance, fluoresce under ultraviolet light and thus can be identified. The presence of ringworm, to name just one, is detectable owing to the fact that it fluoresces a brilliant, metallic green under the rays.

An invaluable aid to the doctor and the detective, ultraviolet light now is working day and night to preserve the lives and protect the property of thousands. And scientists admit that our understanding of the possibilities of the strangely powerful "dark" rays has only begun. In the beginning, they may have started life itself. There is no way of telling what they may be made to do for humanity in the future.

BEADS TAME LAST CANNIBAL TRIBE

(Continued from page 54)

erful bows used by any Indians in the New World.

The Seri never use horses or cattle as riding animals, or for any purpose except food. All their hunting, fishing and traveling is done on foot, and they think nothing of a run of 100 miles on the desert. Though they live on an island, they are poor swimmers.

Men and women are tall, from five and one half to six feet, and the younger men are able to run down deer or horses, turning them back to the clan settlement, when the animals may be killed or eaten. I once saw seven Seri, four men and three women, devour a full-grown steer in one day, sleeping all that night and all the next day on the ground beside the remnants of their feast.

THIS summer, I attended the marriage of Chico Romero, the chief of the Seri, on Tiburon Island. This is his Spanish name, but he has also an Indian tribal name, which is never mentioned before outsiders, and his personal name, known only to himself and his clan god, which, in this instance, is the pelican. Every Seri man has such a name, which is never spoken, and which he takes himself secretly, when he is twelve or fifteen years old.

The older women of each of the seven clans, known as clan-mothers, decide most of the questions that arise within the tribe, and the chief is really a leader only in war and in hunting, turtle fishing and pelican killing.

While we were on the island Romero called the tribe together and asked permission to marry the woman he had chosen. Some of the clan-mothers were opposed to it, the main reason being that each of them wanted to marry the chief. Finally, with gifts and speeches, Romero won over all but one man, who had been trying to win this woman for himself. This man disappeared, and Romero, three other warriors and I pursued him, for fifteen miles, back and forth on Tiburon. *(Continued on page 138)*

BEADS TAME LAST CANNIBAL TRIBE

Continued from page 137

When we caught him, I gave him an old hat I was wearing, in return for his consent to the marriage. Romero and the woman then stood up before the tribe and declared themselves married, after which he took his weapons and other belongings and went to her hut, or *jacal*.

When I was a boy twenty-five years ago, a party of fifty Seri, on foot, raided the San Francisco de Costa Rica ranch, then owned by my maternal grandfather, Pascual Encinas, who, with some twenty armed and mounted cowboys, and myself started in pursuit. The Seri were on foot, driving six horses they had stolen from the ranch.

We knew the great Seri desert as well as they did, and we had a mule-team carrying water, while they had to depend on the scattered springs and water-holes. We never caught more than glimpses of them, and during the pursuit the Seri killed three of the cowboys in night raids on our camps.

Only the women of the Seri paint their faces, using red, white and black natural dyes for that purpose. The women of each clan—Turtle, Pelican, Deer, Rabbit, Snake, Mountain and Butterfly—paint their faces in designs to represent the deity of the clan to which they belong. Seri religion is a pantheism, with minor gods in every tree, mountain, wind, whirlwind, sea, eddy, spring, and all other natural phenomena.

They also have a God of Above, who has wings, and a God of Below, who has long claws for digging. In common with other Indian tribes, they believe that the courage and spirit of the man or animal they eat enters into their own bodies. Their only domestic animal is a half-wild dog, closely related to the coyote.

While these curious and savage people, filled with a deep-rooted hatred of all human beings outside their tribe, could not be pacified with the weapons of war they are yielding rapidly to the mechanics of peace. This year, the Mexican government is sending research pathologists among them in an effort to learn what has been the cause of their reduction in numbers from 10,000 of thirty years ago, the 7,000 of twenty years ago, to the 2,000 of today.

While Seriland is by no means safe for any traveler unless he has a large and well armed escort, and is familiar with desert travel, the Seri have so far progressed that they now will meet representatives of civilization at certain stated points in their domain and permit these agents to escape alive.

NON-SKID ASPHALT IS FOUND IN EAST INDIES

Driving cars over a welted section of experimental roadway in London the other day, British highway engineers tried, unsuccessfully, to make the machines skid. The motorists' terror of skidding on wet streets had been eliminated from that stretch of road because it had been surfaced with a kind of asphalt found only in the island of Buton in the Dutch East Indies. It had never been used commercially because it was found to be thickly mixed with great quantities of fossil dust, giving it a dull gritty surface.

Its application to roadways was brought about by accident. Samples of it had been sent to England for analysis and the chemists discovered that it would not take a polish, and they could not make it lose its gritty appearance. They then suggested that it be tried as a road surfacing material, and found that cars would not skid on it.

PLANT PILLS GROW CROP IN SAND HILL

(Continued from page 56)

to spring up as plants do in an educational movie. So he tried putting on additional chemicals. The result was that some of the flowers died. After that, he stuck to the original formula.

In five weeks, the lettuce had headed and the tomatoes were more than two feet high. In another two weeks, the tomato plants had gained an additional foot and were in full bloom. The lettuce was two feet high and had gone to seed.

On August 29, just nine and one-half weeks after planting the four-inch tomato plants in the sand, Patterson picked his first ripe tomatoes. By September 15, the four plants had produced eighty-six tomatoes, most of them from two and one-fourth to two and three-fourths inches in diameter, and there were still one unripe ones still in sight. One cluster of three ripe tomatoes tipped the scales at twenty-two ounces. One of the largest weighed ten and one-half ounces. On October 12, the plants were still growing and were still in bloom.

The gladioli spikes attained a height of more than a yard and bore many perfect blossoms. The zinnias and asters became a mass of blooms and the forget-me-nots continued to spread and flowered three times during the summer. In ninety-seven days the gladioli completed their life cycle and turned brown. This was more than two weeks before similar plants in the ordinary gardens of the region had completed their cycle.

Patterson's unique "chemical fed" garden grew like an oasis in the middle of the stretch of bare sand. Keeping the sand in the trough moist may have contributed something to the success, but it was his homemade "plant pills" that made possible his spectacular success. These results are all the more remarkable because only the common run of seeds and plants was used. In fact, the four tomato plants, which were purchased at a corner grocery store, proved to be of three different varieties.

Next summer Patterson plans to conduct his experiments on a larger scale. He will use four or five bushels of sand, using a different chemical formula for each one, and will try out his highly concentrated plant foods on a wide variety of garden vegetables and flowers.

While the formula which Patterson used is being kept a secret until complete tests have been made with it, his success will undoubtedly encourage other enthusiasts to follow similar lines of study. Such experiments are sure to add a fresh thrill to the pleasures of home gardening.

CURE OF DISEASE ADDS TEN YEARS TO LIFE

Children born in 1930 may expect to live ten years longer on an average, than babies born in 1910. In that year the "expectation of life at birth" was forty-eight years. Now we are told by the United States Public Health Service, the average length of life is fifty-eight years.

This increase is due to scientific achievements in the cure of ailments which once took a high toll of infant life. Smallpox, diphtheria, scarlet fever, yellow fever, and bubonic plague no longer menace babies standing at the threshold of this life. There is still, however, a large wastage of life due to our failure to apply existing means of combating disease.

A definite program for getting ahead financially will be found on page four of this issue.

MAKE YOUR HOUSE LIVABLE

(Continued from page 77)

room to provide necessary space for piping.

The fittings in the cellar are conventional, but I made sure to set the boiler in a separate room so that it could be shut off from the rest of the cellar. This, in my opinion, always is desirable no matter what fuel is burned. For the heating plant I chose a triple service outfit that gives vacuum vapor heat, supplies hot water the year around, and also incinerates the garbage.

In many ways the question as to whether a house is livable or not depends to a large extent upon the arrangement of the first floor.

No matter what the size of the house it is always desirable to have as large a living room as possible. In my house the living room measures seventeen by twenty-four feet and the useful size is greatly increased by the absence of any visible radiators. The latest type of concealed radiators are used. These add to the appearance of any room and greatly facilitate decorating the room in any desired style.

THE two-car garage is separated from the living room by a fireproof wall. This location of the garage is especially convenient because the house owner can step into the garage from the hallway without passing through the kitchen or going downstairs.

The main hall contains one feature that I consider adds materially to the appearance and also, strange as it may seem, actually saves space. Instead of the usual straight stairway leading to the second floor I designed a curved stairway that arrives at the second floor on a smooth easy curve. The effect is most pleasing, as the illustration shows, and the expense is only about $300 more than for the conventional type stairway of equal grade. The dining room opens off the other side of the main hall and the same general type of decorations, including concealed radiators, is carried out here as in the living room.

Next to the dining room is a breakfast room that is practically an enlarged passageway from the kitchen into the dining room.

The breakfast room is heated by a concealed radiator, and in order to carry out the general style of decoration and yet provide a pleasing variety the breakfast room is finished with a linoleum floor. Pine plank walls and furniture are left in their natural finish.

At first glance, the kitchen does not catch the attention either in the plans or in the photograph. However, I spent a vast amount of time in designing this kitchen in an effort to make it just as practical as possible. I believe that women who study the plan and photograph carefully will agree that this result has been accomplished.

TO begin with, a large kitchen inevitably means many steps so my kitchen is only eight feet six inches wide and sixteen feet long. A double sink is placed in the center of the outside wall right under the windows. Directly opposite it is an enormous cabinet with the range on one side and a built-in electric refrigerator on the other side. The electric refrigerator mechanism, in order to add space for a vegetable locker, was removed and placed in the cellar underneath the stairs where it is out of the way.

At each end of the sink is a large cabinet so there is room for storing as many dishes, pots, pans, and other cooking accessories as could ever be used by any family living in a house of this size. As a matter of fact the same features could be incorporated in any kitchen of the same width even if it were shorter.

The end of the kitchen provides an open space from which there are doors to the back hall, the kitchen entrance, and a large closet that backs up on the curving front stairway. Next to the kitchen is the back stairway leading down into the cellar and up to the second floor, and between that and the garage is a lavatory that opens into the rear end of the hall.

THE second floor provides four bedrooms and three baths. The master bedroom is heated by concealed radiators as is the living room directly under it. A feature of the design is that the upper portion of the oval forming the stairs in the front connecting hall between the north and south sides of the house and the curving shape makes possible a back hall and also considerable closet space.

The third floor contains two maids' rooms and a bath plus plenty of closet space and miscellaneous storage space underneath portions of the roof.

In most houses where maids' rooms are built into the attic, the servants are kept sufficiently warm in winter and entirely too warm in summer. Any room directly under the roof is bound to be excessively hot in summer unless special precautions are taken. I have found, however, that these rooms are satisfactorily cool in summer simply because balsam wool insulation is applied to the roof. This heat insulation not only provides cool attic rooms in summer but also materially reduces the heating bill in winter as it cuts down the heat radiation through the roof.

It has been my experience that few prospective home builders realize what a big saving can be made in the yearly heating bill by proper attention to heat insulation not only of the roof but also of the walls. I specified cane fiber board for all walls and my oil bills are noticeably lower than for similar houses not so well insulated.

IT costs more to build a house that is heat insulated, but the steady, year-after-year saving in fuel bills, no matter what fuel is used, soon pays back the first cost and the saving after that is all velvet.

In addition to the money saving, proper heat insulation produces a more livable house. In summer the sun cannot turn the interior of the house into a too realistic imitation of the hot room in a Turkish bath.

Now I wish to make a confession. Although I set out in the first place to make a house that was livable within a definite price limit, I will have to admit that I spent several thousand dollars more than I originally planned. I made no changes in the design of the house but I did purchase more elaborate fittings in the bathrooms and higher grade lighting fixtures throughout the house than I had planned. Also I spent extra money on heat insulation both in the roof and in the walls. Both these expenditures I consider good investments.

I have found that fine bathroom fittings and high grade lighting fixtures add much to the resale value of a home, especially if they are artistic and in keeping with the general scheme of decoration.

GOLDFISH SKIN SHOES

Even goldfish skins can now be used to cover evening shoes for women. The result is a glittering pair of slippers of unusual brilliance. A tanning process discovered by a German scientist, George Ahrenreich, preserves the tender skins of the New Zealand species of goldfish which are used.

INSIDE STORY OF HOW ANIMALS ARE FILMED

(Continued from page 50)

sters with whom he "works" that he will follow them wherever they go. Frequently the director calls for a scene in which Pete appears alone.

"Then," explains Harry Lucenay, his owner and [illegible] I use signals. By hand motions I can get him to do nearly anything the action may demand. We rehearse the scene several times, when I take him through and explain what he is to do. If the action is something Pete enjoys, fewer rehearsals are required.

"I have no trouble keeping him quiet. In fact, he can even interpret certain sounds. In taking still pictures, for instance, Pete will strike a pose on command and hold it until he hears the camera click twice. During a scene, he will continue his action or hold a pose until the director says 'cut.'

"WHEN sound first was used in pictures, I realized we would be forced to devise new means of directing animals. In the old days dogs would obey us far away as they could hear commands. Now, unless they are taking part in a chase or something similar, they must be kept within range of the director's vision.

Once when we wanted a dog to yawn we could tell him to yawn and the audience would be no wiser. Now we carry him through a rehearsal of a yawning scene. When the camera is going, I stand off-stage and go through the same action. He sees me, mimics me.

If I want him to lie down, I signal downward with my hand. If I want him to stand up, I motion upward. He walks to any one or any object when I point in that direction. In fact, nearly all directions are conveyed by hand signals. In changing from silent to talking pictures we gradually have eliminated commands in favor of signals. Recently ever animals have appeared in pictures because directors and cameramen found it too difficult to get proper action through use of signals. Dogs and elephants have met success with signals, however."

While many owners of dogs today find employment with their animals in various types of pictures, the advent of talkies has thrown many others out of employment. Universal, which in the old days made so many thrilling animal pictures, early this year sold its zoo.

In filming a recent picture, 3,500 sheep were assembled at the Paramount ranch near Calabasas. This flock said to be the largest ever assembled for motion picture work, depicted several large herds in southern California. The sheep appeared in sequences showing them being driven into New Mexico during the days immediately following the Civil War. They were secured from several points and herded across country.

COWS, horses, and sheep have appeared in feature pictures. Recently a herd containing thousands of caribou was stampeded in the rim of the Arctic circle for a thrilling sequence. In one picture now being filmed, donkeys, mules, goats, ducks, chickens, geese, and horses will appear.

Cats appear often on the screen as pets, but they seldom take part in any action.

There was one recent exception. In a comedy one of the principals was told he had inherited $2,000,000. Forthwith he fainted and dropped the telephone over which the message had come. His pet cat wandered up to the instrument, attracted by an odorous "lure" rubbed on the receiver and, when its trainer made a motion with his hand, promptly fell over in a faint.

ERMINE FROM YOUR BACK YARD

(Continued from page 24)

fur-bearing breeds for $5. Rabbit experts differ on the best breeds for fur, but there seems to be a majority opinion in favor of the New Zealand white, the new Flemish Giant, the Himalayan, and the French silver, for white pelts. These skins are usually the most valuable and the most readily salable because of the ease with which they may be dyed to any color or pattern.

Among colored rabbits, the American Blue, the American Silver Black Fur, the Silver Black Giant, and the Blue Flemish seem to be most popular and most productive. Experts say that greater success will be reached by the small producer who sticks to one breed than by the grower who undertakes to raise several varieties. The Flemish Giant, owing to its weight of ten to twenty pounds, with a market value of fourteen to seventeen cents a pound, is the most profitable as a meat rabbit, while the large pelt of excellent pure white fur brings a higher price than the smaller or colored varieties.

Feed is mainly alfalfa cut before the plant has blossomed and rolled oats, the kind that is fed to stock. Carrots, beet leaves, green alfalfa and green barley with other greens are fed in limited amounts and the backyard rabbiter should let his rabbits clean up all their food before giving them more. There is as much danger of over as of under feeding.

The California Agricultural Extension Service says that a maximum of two ounces of feed daily for each pound of weight is ample, and will allow some waste. The proportions of alfalfa hay to grain are placed at about one and one half pounds of the former to one pound of rolled oats. Clean, fresh water, in perfectly clean dishes, fixed so high on the sides of the hutches that the rabbits have to stand up to drink, is an essential. Diseases are transmitted from rabbit to rabbit by unclean watering facilities.

It is necessary to keep a complete record of each rabbit, and identification is assured by various methods of branding, tattooing, and marking of the ears. The meat from a six-months-old fur rabbit will weigh five pounds or more, usually more if the animal is a Flemish Giant or New Zealand White. On the average, throughout the United States, this animal, dressed, will bring twenty-five cents a pound. If sold with the pelt, that is, "live weight," the price will range from fourteen to seventeen cents, due to the loss in dressing out.

But since it is almost as easy to save a rabbit fur as it is to throw it away, the man who wants a fur coat from his own yard kills his rabbit, cuts a ring around each hind leg and each foreleg, and removes the head. Then he hangs the carcass by one hind leg to an iron hook and strips the skin off much as a boy gets out of a sweater.

Then the amateur fur producer puts the skin, inside out, on a wire stretcher, a pair of homemade scrapers off all the fat he can find, draws the skin right on the wires and hangs it up in a cool, dry place out of the sun or other heat to cure. Then he sells the meat for enough to pay for the cost of producing the rabbit, or a little more.

If the rabbit skins are to be sold they should not be tanned before being shipped. At best, home tanning, unless done by an experienced operator, usually is not successful. Even if fur is to be made into coats and other garments for the use of the rabbit raiser, better results will be had if the dried pelts are shipped to a furrier for preparation and tanning in the most effective way.

WORK MINE IN SPITE OF FIRE

(Continued from page 26)

frequently, caused mostly by contact of the timbers with the heated ground. This often was so hot that the miners dared not touch it with their hands, and at times they had to stand on wooden boards to prevent their shoe-soles from burning! Even now, in drilling and blasting, it is necessary at times to wrap the powder in asbestos paper until the miners run to safety.

By 1910 the fire had eaten its way down 1,100 feet from the surface, involving three fourths of the ore area down to that elevation—a mass of nearly 15,000,000 tons of rock and minerals, heated to temperatures varying from 100 to 1,200 degrees. Nearly all the timber had been at least partly burned.

IT was then that the fire area was walled in with concrete bulkheads on each level. In spite of that, operations from the 1,000 foot level to the surface often made fire fighting necessary. Heat, conducted through rock and hot dust filtering through cracks, ignited timbers. Many efforts were made to put the fire out. At one time, huge quantities of carbon dioxide were pumped in, but without much success. Even live steam under high pressures proved ineffective.

During those years many lives were lost, some in the flames, others in rave ins. Once the power plant and smelter buildings settled. Again, a railroad car dropped into the mine and never was retrieved. Later, the entire assay office slid into the mine, and the chief chemist was killed. After this, the surface plant and smelter were moved a distance of eleven miles.

Five years ago, surface mining with steam shovels was begun to take the ore from the fire area. Before starting operations, it was necessary to strip away 10,000,000 cubic yards of waste material covering the ore. When the new method was tried, the miners wore helmets and gas masks to guard themselves against the poisonous gases escaping from the fires below. But these devices did not give them sufficient protection.

Finally, the engineers decided to "bank" the fire. Slimes—water mixed with sand and finely ground ore waste—were brought in sealed gondola cars from a mill built especially for the purpose, and sluiced by centrifugal pumps through a pipe line to drill holes five to six inches in diameter and thirty to one hundred feet deep. The slimes permeated fractures in the ton section and tended to put out the fires and prevent gas from rising to the surface.

After six months of this method, active fire was eliminated over three fourths of the area between the surface and the 700 foot level. But even now, blazes break out every so often. The last big fire occurred in February, 1929, on three levels. It burned nearly six weeks.

A force of watchmen working on a twenty-four-hour schedule patrol all timbered areas, and forty trained fire fighters are on call day and night.

Exactly who first discovered the presence of valuable ores at United Verde, believed to be the first copper mine found by white men in the United States, is not known. While operations date back to 1880, oldtimers say even the Indians had noted seepage water bearing traces of copper coming out of the surface, and used the red ochre they found there for their war paints. In 1887 the property was acquired by the late Senator William A. Clark, and operations were started less than two years later. They have continued ever since.

MIDGET SETS AT LOW COST

(Continued from page 81)

size of the dynamic cone speakers used in the mantelpiece radio sets, surprisingly good tone quality is obtained. It is, in fact, far superior to the tone quality of the finest and most expensive sets made only a few years ago.

Screen grid tubes are universally used in the small sets to obtain the desired degree of radio-frequency amplification. In some sets three screen grid tubes are used in combination with a power detector and a single stage of audio-frequency amplification. In others, two screen grid tubes are employed.

The new small sets are sold at prices in the neighborhood of fifty dollars. This low price, combined with satisfactory broadcast reception, is, of course, responsible for the great success of the mantelpiece radio.

The advent of the mantelpiece radio may affect another phase of the business. Remote control, which appeared only a short time ago to be one of the coming improvements in radio (P. S. M., Nov. '30, p. 78), is likely to be pushed into the background again.

A high grade set fitted with remote control arranged to be operated from several different points will cost about two hundred dollars. For that much money you can purchase four of the new small radios and place them where desired.

NEW RADIO BATTERY LIVES ON AIR

(Continued from page 82)

not necessary to fit fixed resistances if you have or can borrow an accurate filament voltmeter. Just turn the rheostats on slowly till the voltmeter, which should be connected directly to the tube filament terminals, reads exactly 2.2 volts. Then take off the knobs of the rheostats and saw off the shafts or otherwise lock them to prevent anyone from changing the setting.

In this connection it may be well to call attention to the fact that old sets using 199 and 120 tubes can be operated with the new 230 and 231 tubes only if they are of the ordinary tuned radio-frequency variety. Superheterodyne and neutrodyne sets of commercially built types require special attention from the service man representing the manufacturer.

The new air cell battery has a maximum continuous current output of three quarters of an ampere. If this load is exceeded the "breathing" carbon electrode loses its ability to soak in oxygen and the battery will be ruined.

Air cell batteries are shipped dry and there is, consequently, no deterioration while in the hands of the dealer. The user simply fills each of the two cells with water. Distilled water is not necessary. Any water fit to drink will do.

DUST, CARRIED HIGH BY WIND, FALLS AS MUD

EXPLANATION of the showers of mud that sometimes fall is simple, according to the United States Weather Bureau, reporting on the recent downfall, at Edenton, N. C. They usually occur in or near sections of the country where there is a great amount of loose surface dust. Strong dry winds raise this, carrying it into the upper air, where it becomes mixed with rain and falls as mud.

Showers of mud have been most common in the Middle West, where dust is thicker and lighter, and consequently easily picked up by strong winds.

Skiing Is Thrilling Sport Easy to Learn

(Continued from page 39)

ft, you now are ready to learn walking or sliding on level ground. Here we go! Lunge forward on one foot, keeping the weight well on the front ski. Before the skis stop, lunge forward again and slide on the other ski, transferring your weight. The chief points to remember are: Never lift the skis from the ground and *keep sliding*.

Propel your skis with easy, dipping motions of the legs and manage your weight with corresponding balancing motions of the arms. The action somewhat resembles skating, except that the feet are not turned sideways to make a forward push, but are kept in a straight line.

The next thing to master is sliding downhill. This is where the fun begins. I can give you only one rule for sliding, but that one is important: Don't bend either the body or the knees, but keep perfectly straight. The rest is a matter of practice and achieving form. No two skiers ride downhill in the same way; neither do they jump in the same fashion. Start with low hills that have level slopes. Then take steeper hills. After those, try hills with bumps. All this is easy, and should take no longer than two or three weeks.

AS a majority of ski runners make curves on level ground with the momentum attained by sliding downhill, you now are ready to try your hand at curves. There are several kinds of turns, but the principal types are the Christiania swing and the Telemark swing. The Christiania is the easiest.

Move the left foot forward so that the heel of the left foot is even with the toe of the right and keep your body weight on the left ski. Steer to the left with your weight and make the right ski follow by a slight dipping motion of the knees to produce the necessary slide, holding the arms out straight to maintain balance. Continue again with the left ski, twisting the body to keep the weight on the left foot, but holding back a little for the sake of balance. Repeat these steps until the curve is achieved. In making the turn to the right, it is necessary to reverse the process.

The Telemark is the prettiest and most popular of the curves, and expert skiers often use it as a finish to a perfect ski jump. In this curve you turn to the left by pushing the *right* ski two feet ahead of the left. Then stretch the arms out straight. Bend the left knee way down and the right knee a little, meanwhile twisting the right ankle to the left and leaning in toward the left until the swing is completed. Here, as you see, the right ski is the steering ski.

If the Telemark is made to the right, the entire action is, of course, reversed. But since with most people the right leg is stronger than the left, the curve usually is executed to the left. I make the Telemark both ways, but something tells me that it will take you quite a little while to do this.

Sliding downhill is great fun and almost anyone can do it in some fashion, but going uphill is not so easy. The main thing in hill climbing is to make a quick study of each hill as you come to it. Carefully observe its shape and the character of the upgrade and map out a little campaign as to how to reach the top.

If the hill is low and of gentle slope, walk straight up with the aid of your two poles. All skiers use two poles, except the Lapps, that strange race of Mongolian people who inhabit the northern parts of Norway, Sweden, and Finland. They are the only skiers who never use more than one pole. The reason is that they utilize it as a weapon in their frequent fights with the wolves that attack their reindeer herds. In such a battle, a second pole would be a severe handicap.

To climb steep hills, you must resort to side-stepping, half-side-stepping, and herringboning. In side-stepping you simply turn your profile to the hill and walk sideways. It is used in tramping the ski hill below the take-off. In the half-side-step, you push one ski forward diagonally, at the same time making sure to bring up the heel of the ski in such a way that the ski in its new position is parallel to but ahead of the other ski. Then lift up the lower ski to take its place beside the other.

The half-side-step is the least fatiguing and most useful of all hill-climbing steps. The herringbone, used to climb steep, short, narrow trails and to negotiate hilltops quickly, is much more difficult and a considerable strain on the leg muscles. Face straight up the hill. Keep the feet apart and turn your toes out as far as convenient. Then walk uphill Charlie Chaplin fashion.

The next trick to learn is the kick-turn. This is almost indispensable in hill climbing, and especially useful in reversing your position on steep slopes. Let us suppose you want to make a kick-turn to the right. Lift the right foot as high as you can, twist it to the right, and bring it down with the ski in a horizontal position, so that it clears the toe of the left ski. Now, shifting your weight to the right and lifting the left foot, turn it and then bring it down beside the right. The kick-turn is used only on steep hills, or when going over a fence.

As for braking, snow-plowing is the easiest method, especially if you have no poles. It is best to try the snow-plow when not under too much speed. Straddle the legs wide apart, force the heels out, and bring the points of the skis as close together as possible. The skis, in this position, will be forced half sideways instead of end on through the snow. To make the snow-plow still more effective for braking, edge the skis by making yourself knock-kneed. When under great speed, snow-plowing is better as a preventive than as an actual means of stopping, because when you are coming down very fast all your strength may not be sufficient to hold the skis apart. Stemming is half snow-plowing. To stem, simply run one ski straight ahead and force the other partly sideways through the snow.

JUST a few words about handling the poles. On level ground, they may be used effectively in two ways. One is to propel yourself by alternate downward punches of the left and right pole, using your arms much in the same way as when climbing a steep stairway with the aid of two banisters. The other method somewhat resembles rowing. Hold the poles in back of you, swing both forward simultaneously, punch the spikes into the ground, and literally pull yourself through between the poles.

When you have mastered all the foregoing, you are ready for the dessert of the meal—jumping. Most people are under the impression that ski-jumping is dangerous, but this is not true so long as the skier does not overreach himself. I started in my native Norway when I was eight years old, and never had an accident until 1924, when I was twenty. The track was icy and on the take-off, just as I was about to make the leap, I fell backwards with my legs up in the air and landed 110 feet downhill at a speed of forty miles an hour. I tried hard to get back onto my feet, but in vain. I landed on my arm and broke it in two places.

The only other accident I suffered occurred last year. In February, 1929, I won the national amateur ski championship at Brattleboro, Vt., jumping 141 and 131 feet. In October, I went to Norway, to "show my medals" to my mother. And just like a soldier who goes through a war unscathed and, on coming home, breaks his neck by slipping on a banana peel, I fell while practicing one morning on a very low hill near our house. I sprained my arm so badly that I was laid up for five weeks. My mother's good care and massage treatment, however, put me back in condition, and I was able to compete again in the national meet at Canton, S. D., in February, 1930, when I lost the championship to Casper Oimon by one foot.

I have told of these personal experiences to show the low average of accidents in skiing. Two comparatively minor injuries in eighteen years certainly indicate that this thrilling sport is far from dangerous.

In learning to jump, start on a low hill, but one with a slope of sufficient length to prevent you from striking level ground! We never hit the level in ski-jumping, because if we did the shock might be injurious or even fatal. It simply would be like jumping off a building. Instead, we always land on the lower end of the slope and slide down to level surface, usually ending the jump with a graceful curve or swing.

During the rundown, always slide naturally. This is one of the main secrets of good form. Your attitude should be easy and steady, with the upper part of the body leaning a little forward. Never retard your speed. Keep your arms at your side, bend your knees slightly, and preferably keep them together. The skis must be kept *close together*.

As you approach the take-off, gradually increase the bending forward of your body and the bending of your knees. Throw the weight of your body more and more forward, the skis *always close together*. When you reach the edge of the take-off, straighten the knees and body vigorously and throw your body forward. Don't try to thrust your arms backward.

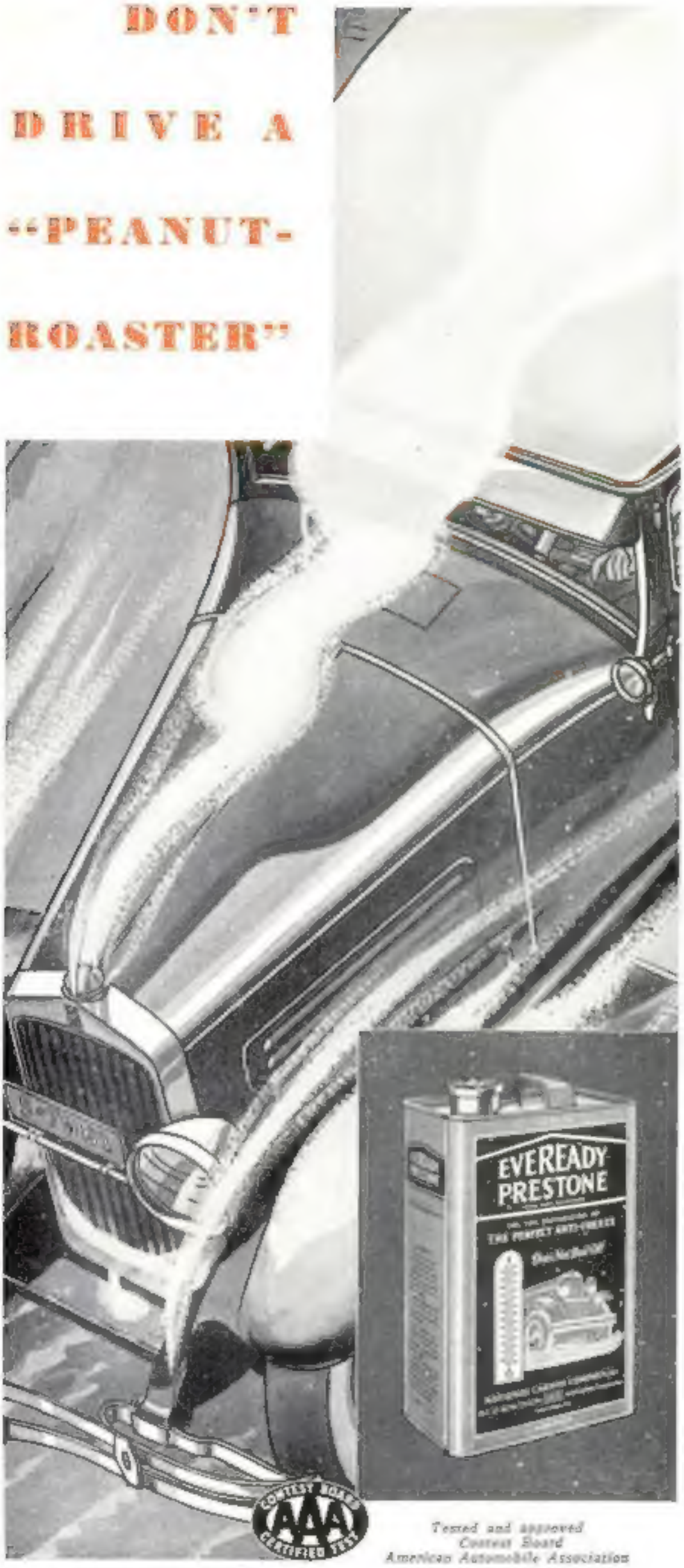
In the air, you must hold your body erect with an increasing lean forward according to the steepness of the landing slope. Your skis must be close together, parallel and in the same plane. Move the arms in an easy, winglike, flying motion. After your skis leave the take-off, they should gradually point more and more downward until parallel with the landing slope at the point of landing. During the last part of the flight, fix your eyes on the spot where you will make contact with the hill so as to prepare yourself for a steady landing.

THE landing must be elastic, springlike, and firm without stiffness. Your body still should be balanced correctly and the skis must still be together. When you land, bend your knees. The knee of the foremost leg should be bent slightly, and the knee of the rear leg more so. If the hill has a comparatively flat landing slope, or if the snow is in poor condition, the foremost foot should be particularly far advanced.

This is the common jump. Only two types are recognized as good form—the common jump and the jackknife. The jackknife is executed in the same manner as the common jump, except that, in the air, the body is bent forward from the hips. You gain the upright position as soon after the landing as possible.

Many skiers have jumped distances of more than 200 feet, but the achievement of such feats does not class them as great ski-jumpers. The outstanding ski-jumper is he who, in competition and under any set of circumstances, has jumped farther than any other proficient competitor.

DON'T DRIVE A "PEANUT-ROASTER"



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